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## 1.0 PROJECT OBJECTIVES

The project objective is to design and construct facilities for the military that are consistent with the design and construction practices used for civilian sector projects that perform similar functions to the military projects. For example, a Company Operations Facility has the similar function as an office/warehouse in the civilian sector; therefore the design and construction practices for a company operations facility should be consistent with the design and construction of an office/warehouse building.

### Comparison of Military Facilities to Civilian Facilities

Military Facility	Civilian Facility
Family Life Center	School, Meeting Center, Youth Center with Gym

It is the Army's objective that these buildings will have a 25-year useful design life before a possible re-use/re-purpose or renovation requirement, to include normal sustainment, restoration, modernization activities and a 50-year building replacement life. Therefore, the design and construction should provide an appropriate level of quality to ensure the continued use of the facility over that time period with the application of reasonable preventive maintenance and repairs that would be industry-acceptable to a major civilian sector project OWNER. The site infrastructure will have at least a 50-year life expectancy with industry-accepted maintenance and repair cycles.

The project site should be developed for efficiency and to convey a sense of unity or connectivity with the adjacent buildings and with the Installation as a whole.

Requirements stated in this contract are minimums. Innovative, creative, and life cycle cost effective solutions, which meet or exceed these requirements are encouraged. Further, the OFFEROR is encouraged to seek solutions that will expedite construction (panelization, pre-engineered, etc.) and shorten the schedule. **The intent of the Government is to emphasize the placement of funds into functional/operational requirements. Materials and methods should reflect this by choosing the lowest Type of Construction allowed by code for this occupancy/project allowing the funding to be reflected in the quality of interior/exterior finishes and systems selected.**

### 1.1. SECTION ORGANIZATION

This Section is organized under 6 major "paragraphs".

- (1) Paragraph 1 is intended to define the project objectives and to provide a comparison between the military facility(ies) and comparable "civilian" type buildings.
- (2) Paragraph 2 describes the scope of the project.
- (3) Paragraph 3 provides the functional, operational and facility specific design criteria for the specific facility type(s) included in this contract or task order.
- (4) Paragraph 4 lists applicable industry and government design criteria, generally applicable to all facility types, unless otherwise indicated in the Section. It is not intended to be all-inclusive. Other industry and government standards may also be used, where necessary to produce professional designs, unless they conflict with those listed.
- (5) Paragraph 5 contains Army Standard Design Criteria, generally applicable to all facility types, unless otherwise indicated in the Section.
- (6) Paragraph 6 contains installation and project specific criteria supplementing the other 5 paragraphs.

## 2.0 SCOPE OF WORK

### 2.1 CHAPEL FAMILY LIFE CENTER and MULTI-PURPOSE ACTIVITY CENTER

2.1.1 Provide an Army Standard Design Chapel Family Life Center as defined herein with appropriate visual and structural adaptation to the assigned site. The Army Standard Design Chapel Family Life Center provides a counseling suite capable of supporting a couple of small groups and individuals at the same time. This suite includes administrative and other support for those activities. To provide for counseling training and planning the facility also includes 14 other gathering spaces suitable for training and accessory activities to support the counseling mission. The smallest of these spaces is suitable for a small group of from 8-10 persons and the largest space is suitable for up to 150 persons and includes a kitchen for events that include the keeping and serving of pre-prepared food. Include all appropriate coordination with the (shared with the Multi-Purpose Activity Center) site. Staff capacity will generally be 7 persons. Variations and visitors to the administrative staff might range from 3 to 10 total persons, combined. Provide an enclosure for a "dumpster container". The basic plan is relatively fixed, although slight revisions to accommodate structural members or similar features are acceptable. The general concept behind the plan is to allow for the support of the spiritual well-being of soldiers and their families from multiple faith groups and to provide for a great deal of flexibility in how some of the spaces might be used. Consequently, visual adaptations that focus on a particular faith group are not acceptable.

2.1.2 Provide a Non-Standard Design Multi-Purpose Activity Center as defined herein with appropriate visual and structural adaptation to the assigned site. This is a unique facility type developed to augment and strengthen the spiritual health of the military community with particular focus on the needs of families with young children. The facility provides a larger activity space capable of supporting a wide variety of athletic activities for children. The facility also includes a special crafts and arts classroom and the appropriate administrative and support spaces. Include all appropriate coordination with the (shared with the Chapel Family Life Center) site. Staff capacity will generally be 3 persons. Variations and visitors to the administrative staff might range from 1 to 8 total persons, combined. The basic plan shown for this facility is less developed and meant to be more flexible regarding layout to support the functions as well as the normal slight revisions necessary to accommodate structural members or similar features. Proposers are encouraged to suggest variations that appear to better support the functions and space adjacencies described. The general concept behind the plan is (also) to allow for the support of military families of multiple faith groups. Consequently, visual adaptations that focus on a particular faith group are not acceptable.



## 2.2. SITE:

Provide all site improvements necessary to support the new building facilities. Refer to Paragraph 6.

Approximate area available 4.00 acres

## 2.3. GOVERNMENT-FURNISHED GOVERNMENT-INSTALLED EQUIPMENT (GFGI)

Coordinate with Government on GFGI item requirements and provide suitable structural support, brackets for projectors/VCRs/TVs, all utility connections and space with required clearances for all GFGI items. Fire extinguishers are GF/GI personal property, while fire extinguisher brackets and cabinets are Contractor furnished and installed CF/CI. All Computers and related hardware, copiers, faxes, printers, video projectors, VCRs and TVs are GFGI.

The following are also GFGI items: No additional Requirements. See paragraph 3.

## 2.4. FURNITURE REQUIREMENTS

Provide furniture design for all spaces listed in Chapter 3 and including any existing furniture and equipment to be re-used. Coordinate with the user to define requirements for furniture systems, movable furniture, storage systems, equipment, any existing items to be reused, etc. Early coordination of furniture design is required for a complete and usable facility.

The procurement and installation of furniture is NOT included in this contract. Furniture will be provided and installed under a separate furniture vendor/installer contract. The general contractor shall accommodate that effort with allowance for entry of the furniture vendor/installer onto this project site at the appropriate time to permit completion of the furniture installation for a complete and usable facility to coincide with the Beneficial Occupancy Date (BOD) of this project. The furniture vendor/installer contract will include all electrical pre-wiring and the whips for final connection to the building electrical systems however; the general contractor shall make the final connections to the building electrical systems under this contract. Furthermore, the general contractor shall provide all Information/Technology (IT) wiring (i.e. LAN, phone, etc.) up to and including the face plate of all freestanding and/or systems furniture desk tops as applicable, the services to install the cable and face plates in the furniture, the coordination with the furniture vendor/installer to accomplish the installation at the appropriate time, and all the final IT connections to the building systems under this contract.

The Government reserves the right to change the method for procurement of and installation of furniture to Contractor Furnished/Contractor Installed (CF/CI). CF/CI furniture will require competitive open market procurement by the Contractor using the Furniture, Fixtures and Equipment (FF&E) package.

## 2.5. NOT USED

### **3.0 FUNCTIONAL/OPERATIONAL REQUIREMENTS FOR THE CHAPEL FAMILY LIFE CENTER AND MULTI-PURPOSE ACTIVITY CENTER FACILITY TYPES**

#### **3.1. GENERAL INFORMATION**

Provide an Army Standard Design "Chapel Family Life Center" (CFLC) and a non-standard design Multi-Purpose Activity Center (MPAC) as defined herein. Unless identified as Government Furnished /Government Installed (GF/GI), items identified herein shall be considered Contractor Furnished /Contractor Installed (CF/CI) to be provided as part of this contract. Notwithstanding provisions in other sections of the RFP that state the furniture procurement is not included in this contract or shall be Government Furnished/Government Installed, the Government reserves the right to change the method for procurement of and installation of GF/GI furniture (see paragraph 3.2.5.5 Furniture) to Contractor Furnished/Contractor Installed (CF/CI). Such CF/CI furniture will require competitive open market procurement by the Contractor using the Furniture, Fixtures and Equipment (FF&E) package. In addition to these furniture items, the government reserves the right to negotiate for the (competitive open market) procurement and installation of other equipment items (such as appliances) and ecclesiastical furnishings (such as hymnals) not otherwise a part of this contract.

##### **3.1.1. MANDATORY REQUIREMENTS**

The floor plan provided for the Chapel Family Life Center is an approved Army Standard Design and is mandatory. This is still intended to allow for adjustments for structural members, fine-tuning code requirements, and the like. The floor plan for the Multi-Purpose Activity Center has not been as fully developed and is intended to be a general guide with more flexibility for offerer suggested changes, so long as proposals do not include less function and capacity or create problems with the site restrictions.

##### **3.1.2. FACILITY GOALS FOR THE SOLDIER COMMUNITY**

3.1.2.1. The two facilities are intended to support and maintain optimum levels of spiritual health of military families of all distinctive faith groups. The Chapel Family Life Center has a stronger focus on counseling individual, families, and groups. The Multi-Purpose Facility has more focus on supporting the spiritual community component that strengthens families with young children. These goals will impact the layouts and designs of casework, hardware, decorating features, etc.

3.1.2.2. Each facility is intended to support administrative activities necessary to operate and maintain the facility in a manner that ensures maximum support for the military community and the Installation. These goals will impact finish choices, fitting quality and selection of features.

3.1.2.3. Each facility is intended to provide the highest levels of personal safety, resource integrity and construction technology while also inspiring and encouraging the Army community and the individual user. These goals will also impact the layouts and designs of casework, hardware, decorating features, finish choices, fitting quality and selection of features.

##### **3.1.3. FACILITY GOAL FOR OPERATING STAFF**

All of the individual and group activities require support from the Unit Ministry Teams (the assigned group of Chaplain Staff defined for each installation). In turn, these teams require support in the form of professional administrative, activity and personal counseling spaces. Team members will be seeking to support the military community members and their Installation in three basic ways.

3.1.3.1. The Unit Ministry Team is responsible for coordinating the use of all the different spaces by all the different users, many of which will be from the general Installation military community. Good coordination will ensure the most efficient and effective use of the facility and the greatest number of satisfied users.

3.1.3.2. The Unit Ministry Team is responsible for planning and producing a number of individual and group functions. These could range from counseling or instructing an individual to leading a large group religious activity.

3.1.3.3. The Unit Ministry Team is responsible for managing the maintenance and operation of the facility and its supporting equipment systems in a way that provides a safe, economical and nurturing environment within the facility and extends the life of the facility to the greatest extent practicable. This will allow the facility to fulfill its mission for many years to come in a very sustainable and cost effective manner.

#### **3.2. FUNCTIONAL AND OPERATIONAL REQUIREMENTS**

### 3.2.1. GENERAL

#### 3.2.1.1. Not Used.

#### 3.2.1.2. Not Used

#### 3.2.1.3. Gross Building Area

Provide 27,000 Square Feet of gross building area according to Appendix Q - AREA COMPUTATIONS. 17,000 Square Feet is for the Army Standard Design "Chapel Family Life Center" portion and 10,000 Square Feet is for the Multi-Purpose Activity Center portion, a concept level facility definition needing further development.

#### 3.2.1.4 Net Space Area

Net space area is defined as the area measured to the inside face of the surrounding partitions or walls. Additional defining information is included in Appendix Q - AREA COMPUTATIONS. Provide net area requirements for functional spaces as defined in the AREA TABULATION table on the Floor Plan drawing. If net area requirements are not specified in the Statement of Work or the AREA TABULATION table, the space shall be sized to accommodate the required function, comply with code requirements, comply with overall gross area limitations and other recognized design principles. <CHAP>

#### 3.2.1.5 Accessibility by the Handicapped

The facility shall be handicapped accessible except that for safety reasons, the more elevated raised platform in the CFLC activity center, and equipment areas are not intended to be accessible by unaccompanied handicapped persons.

#### 3.2.1.6 Sustainability

Many features that make a facility sustainable can be integrated into a typical building and site. However, some very beneficial features or materials might also have application but need to have a more tailored building and site to be effective. The offeror is encouraged to suggest sustainable material substitutions or building feature modifications for consideration where they appear to provide benefit without appearing to interfere with functionality.

#### 3.2.1.7 Room Type and Requirements

##### 3.2.1.7.1 General

This facility includes individual offices for chaplains, group offices and other administrative spaces required for the Unit Ministry Teams. The major space type for of these two facilities is the "gathering" space for group activities. Other spaces include those intended to support counseling. The goal is to allow each individual, family, congregation or community group the optimum usable features for their activities in an environment where all share the benefits of a relatively flexible and extremely functional facility. In addition to these specific spaces each facility will include appropriate circulation spaces, toilet facilities, storage spaces and equipment spaces for mechanical, electrical, communication and electronic equipment to support the total building and all of its functions. Carefully compare all of the criteria sections (such as Architectural, Interiors, and Electrical) when planning a specific design project. This facility type is intended to be a key asset for the total Installation and the military community, not a closed asset only for the private use of the Chaplaincy. Visual appearance and exterior material selections shall coordinate well with the patterns set by the Installation and its existing adjacent facilities. The impact of climate, security and geography shall also be addressed appropriately. There may be reasons to control exterior noise from entering the facility that would require special treatment or STC ratings on major building components. Providing appropriate and adequate protection from the wind and wind driven precipitation for doors and entries shall be considered. The development of interior design themes shall relate to the exterior design decisions made and it should receive a thoughtfully coordinated treatment throughout all interior spaces. These interior themes shall also be appropriate to the functions housed. Safety and security for all users will require incorporating features such as thoughtfully placed locking hardware, handrails and non-slip (a generally "smooth matt" finish that shall limit the risks of foot slippage when wet, but not try to eliminate them by presenting a protruding abrasive grit or highly textured surface) floor finishes. Door hardware shall take into consideration the high volume of building users through the week. Interior doors shall be of solid core hardwood but a special STC rated design or the inclusion of complex or actuated sealing devices is not necessary or desired. Provide all appropriate (restroom, equipment room and storage room doors are not appropriate) interior doors with narrow borrow lite windows. Where porcelain tile is called for, install per TCA (Tile Council of America, Inc.), Method F-114 which includes a recessed foundation slab, epoxy grout, and expansion joints per required distances.

### 3.2.1.7.2 Administrative Space for the Unit Ministry Team

Provide the group office, individual office, conference, coffee bar, reception, library, workroom space entry doors with locksets. Provide carpet tile for the floor finish, resilient base for the wall/floor trim, and painted wallboard protected with chair rails (from moving furniture or carts) for the wall finish. Provide suspended acoustic tile with recessed light fixtures in a typical grid pattern type exposed suspension system for the ceilings. The ceiling heights shall be 8'-0" above the finished floor. Partition construction around each space shall supply an STC rating of 52 or better. Provide a glazed borrow lite (approximately 6-feet x 3-feet) between the Lobby and Administrative Group Office. Provide one mechanical push-button or other special keyless (keypad) entry device (for staff use when the facility is closed for regular business) on one leaf of the main entrance doorway for each facility portion. Provide an appropriate amount of base cabinets, counter tops and wall cabinets in the administrative spaces like work rooms, coffee bars, etc. Provide appropriate materials and hardware for all casework features.

### 3.2.1.7.1 Gymnasium Multi-Purpose Room

Provide the MPAC facility with a Gymnasium based Multi-Purpose Room. Provide entry doors with locksets. Provide an athletic activities type floor finish, resilient base for the wall/floor trim, painted wallboard protected as appropriate for a more athletic use facility for the wall finish. Do not provide flooring of the traditional wood type for gymnasiums. Provide a flooring type that requires low maintenance. It may be special purpose flooring designed for athletic activities or a commercial type of flooring that can also accommodate the athletic activity function. Ceilings and lighting format shall be integrated with the ceiling/roof structure. Provide all ceiling and wall mounted devices with protective covers capable of absorbing the impact of fast moving balls or similar items. The ceiling heights (clear play volume) shall be at least 24-feet above the finished floor. Partition construction shall supply an STC rating of 52 or better. Provide glazed sections where indicated with an STC rating that is as comparable as practical and of a design that is also capable of absorbing the impact of fast moving balls or similar items. Provide bracket mounted basketball backboard assemblies that can be raised when not in use or lowered into correct playing position. Provide in-floor devices (with complete safety features) to receive net supports or devices for other appropriate athletic activities, such as volleyball, badminton, etc.. Gymnasium floor shall be in-laid with striping/markings for basket ball, volleyball and 2 AWANA (the name is derived from the first letters of **A**pproved **w**orkmen **a**re **n**ot **a**shamed as taken from 2 Timothy 2:15 and is an integrated program of learning and activities for parents and children established as an aid to congregations with children) squares. See appendix J for drawings and explanation of an AWANA square. Provide the design for an electronic scoreboard and control system. Provide and integrate the conduits to support it..

### 3.2.1.7.2 Counseling Rooms

Provide the counseling room entry doors with locksets. Provide carpet tile for the floor finish, resilient base for the wall/floor trim, and painted wallboard protected with chair rails (from moving furniture or carts) for the wall finish. Provide suspended acoustic tile with recessed light fixtures in a typical grid pattern type exposed suspension system for the ceilings. The ceiling heights shall be 8'-0" above the finished floor. Partition construction around each space shall supply an STC rating of 52 or better. Provide STC rated one-way glass viewing panel (5'-0" x 3'-0") in 1 location as directed by the contracting officer.

### 3.2.1.7.3 Activity Centers

Provide the CFLC activity center entry doors with locksets. Provide porcelain tile for the floor finish, resilient (or porcelain tile) base for the wall/floor trim, painted wallboard protected with chair rails and accented with some form of high quality above-door-height-trim (such as an exaggerated picture molding, a continuous door head molding, a high-on-the-wall plate-rail type molding or a cornice molding) for the wall finish. Wood flooring is recommended at the (stage) raised platform. Ceilings and lighting format shall be integrated with the ceiling/roof structure. The ceiling heights shall coordinate with the ceiling/roof structure. Partition construction shall supply an STC rating of 52 or better. A power operated (from a ceiling slot), projection screen (sized for the volume of the space and vision clarity) shall be provided at the raised platform and a single screen on the opposite wall of the Activity Center (so that a speaker or presenter on the raised platform may be able to see the same things as the audience). Provide a raised platform in this space that is approximately 2-feet-11-inches above the regular activity center finished floor. Because of this height and the risk of injuries from falls, do not provide access to unaccompanied handicapped persons. The raised platform shall be closed off by means of an ornamental curtain. Special decorative features and effects for this space are encouraged. Develop the space below this raised platform for the storage of loaded table and chair dollies with decorative doors to close the space from view. Provide a lockable control console (like a desk with a fold-away locking cover) for the A/V system near the back of the Activity Center. Provide an appropriate array of wall mounted sound absorbing acoustic panels on the Activity Center Walls. Provide rationale for selection/sizing of items such as sinks, equipment and appliances.

#### 3.2.1.7.4 Youth Lounge/Interaction Center

Provide the MPAC Youth Lounge/Interaction Center with stained sealed decorative concrete for the floor finish, resilient base for the wall/floor trim, and (in general) painted wallboard for the wall finish. Provide wall reinforcing and a wall mounted rack to support four game-capable television sets. Provide a relatively open/exposed ceiling and lighting system. Provide a ceiling supported television rack in a round or geometric shape with space to support four television units. The unobstructed "ceiling" height shall be 8'-0" above the finished floor. The walls shall include pre-manufactured bumper rails for protection from moving furniture or carts. All finishes shall be safely compatible with frequent contact by "bouncy" young people. Provide an appropriate amount of base cabinets, counter tops (if a location for wall cabinets exists, they should also be provided) and other features necessary to support a small juice and coffee bar (supporting features for a refrigerator, microwave oven, coffee makers) for people to use while congregating informally in the Youth Lounge and Interaction Center of the MPAC. Provide appropriate materials and hardware for all casework features. Because of the functional intent of this space (a hangout for teens), non-traditional (somewhat zany) floor, wall, ceiling and casework finishes (corrugated metals, unusually textured or color-changing plastics) and colors are very appropriate so other suggestions for these surfaces besides those listed are encouraged. Such suggestions may apply to full surfaces or accent portions of surfaces. While a degree of acoustic liveliness is appropriate for this space, provide acoustic panels or like devices to keep this liveliness from becoming uncomfortable, particularly if highly reflective (such as corrugated metal or high density composite) finishes are proposed.

#### 3.2.1.7.5 Kitchen Suite

Provide porcelain tile for the floor finish, porcelain tile base for the wall/floor trim, and painted wallboard for the wall finish. Partition construction shall supply an STC rating of 44 or better. Provide painted wallboard for the ceiling finish and lighting format. The ceiling heights shall be 8'-0" above the finished floor. Provide base cabinets, counter tops and wall cabinets in the kitchen and storage shelving in each pantry. Provide a small section of casework/countertop that is accessible by the handicapped. Provide spacing for appliances in kitchen, including space for two warming drawers. The ranges ovens, microwave, two refrigerators, and single dishwasher to be supplied (GF/GI) shall be typical high grade residential kitchen type appliances. The warming drawers and ice maker shall be typical commercial type appliances. Coordinate with the Contracting Officer's representative regarding the need for gas or electric ranges and provide all appropriate utilities to support the appliances. Provide appropriate materials and hardware for all casework features.

#### 3.2.1.7.6 Not Used

#### 3.2.1.7.7 Resource Center

Provide the resource center entry doors with locksets. Provide carpet tile for the floor finish, resilient base for the wall/floor trim, and painted wallboard for the wall finish. Provide suspended acoustic tile with recessed light fixtures in a typical grid pattern type exposed suspension system for the ceiling finish and lighting format. The ceiling heights shall be 8'-0" above the finished floor.

#### 3.2.1.7.8 Not Used

#### 3.2.1.7.9 Classrooms

Provide classroom entry doors with locksets. Provide carpet tile for the floor finish, resilient base for the wall/floor trim, and painted wallboard for the wall finish. Provide suspended acoustic tile with recessed light fixtures in a typical grid pattern type exposed suspension system for the ceiling finish and lighting format. The ceiling heights shall be 8'-0" above the finished floor. Partition construction shall supply an STC rating of 52 or better. The walls shall include pre-manufactured bumper rails for protection from moving furniture or carts. All finishes shall be safely compatible with frequent contact by children. Provide base cabinets, counter tops and wall cabinets in the classroom spaces indicated by plan.

#### 3.2.1.7.10 Graphic Arts/Sculpture/Craft Classroom

Provide classroom entry doors with locksets. Provide stained sealed decorative concrete for the floor finish, resilient base for the wall/floor trim, and painted wallboard for the wall finish. Provide suspended acoustic tile with recessed light fixtures in a typical grid pattern type exposed suspension system for the ceiling finish and lighting format. The ceiling heights shall be 8'-

0" above the finished floor. Partition construction shall supply an STC rating of 44 or better. The walls shall include pre-manufactured bumper rails for protection from moving furniture or carts. All finishes shall be safely compatible with frequent contact by children. Provide the design for a kiln and appropriate safe control system. Provide and integrate the conduits to support it. Provide two deep sinks with trap protection features for various art media and approximately 8'-0" linear feet of adjacent base cabinet and counter top. Provide 20 fixed lockable storage cabinet casework, each approximately 3'W X 2'D X 4'H, for storage of art projects - sculptures, paintings, crafts.

#### 3.2.1.7.11 Not Used

#### 3.2.1.7.12 Vestibules

Provide vestibule entry doors (from the exterior) with locksets. Provide interior facing doors with appropriate push-pull devices. Provide porcelain tile for the floor finish, porcelain tile base for the wall/floor trim, and painted wallboard for the wall finish. Provide suspended acoustic tile with recessed light fixtures in a typical grid pattern type exposed suspension system for the ceiling finish and lighting format. The ceiling heights shall be 8'-0" above the finished floor.

#### 3.2.1.7.13 Lobbies

Provide porcelain tile for the floor finish, porcelain tile base for the wall/floor trim, and painted wallboard for the wall finish. For the MPAC, provide a small area of carpeting if appropriate to the offerer's proposal. Also provide a welcome-booth/kiosk (MPAC). Provide suspended acoustic tile with recessed light fixtures in a typical grid pattern type exposed suspension system or as appropriate to integrate with the ceiling/roof structure for the ceiling finish and lighting format. The ceiling heights shall be 9'-0" above the finished floor or as appropriate to integrate with the ceiling roof structure.

#### 3.2.1.7.14 Corridors

Provide VCT or similar low maintenance material for the floor finish, resilient base for the wall/floor trim, and painted wallboard for the wall finish. Provide suspended acoustic tile with recessed light fixtures in a typical grid pattern type exposed suspension system for the ceiling finish and lighting format. The ceiling heights shall be 8'-0" above the finished floor. Short corridor portions coming off of spaces with different types of ceilings may match the ceilings of the connecting/adjacent larger space.

#### 3.2.1.7.15 Not Used

#### 3.2.1.7.16 Not Used

#### 3.2.1.7.17 Storage Closets and Storage Rooms

Provide room entry doors with locksets. Provide composition tile for the floor finish, resilient base for the wall/floor trim, and painted wallboard for the wall finish. Provide suspended acoustic tile with recessed light fixtures in a typical grid pattern type exposed suspension system for the ceiling finish and lighting format. The ceiling heights shall be 8'-0" above the finished floor. Provide open storage shelving in some storage closets. Coordinate this feature with the local chaplains.

#### 3.2.1.7.18 Janitor's Closet and Recycling Center

Provide janitor's closet entry door with a lockset. Provide exposed concrete for the floor finish, resilient base for the wall/floor trim, and painted water-resistant wallboard for the wall finish. Provide suspended painted wallboard for the ceiling finish and lighting format. The ceiling height shall be 8'-0" above the finished floor. Janitor's closet shall include a floor mounted mop sink, shelving for supplies, hanging racks for mops and brooms.

#### 3.2.1.7.19 Toilet Rooms

Provide toilet room entry doors with key-only deadbolt type locksets (for the rare emergency need of closing a group toilet room due to a major plumbing crisis). Provide porcelain tile for the floor finish, porcelain tile base for the wall/floor trim, and painted wallboard with porcelain tile wainscots for the wall finish. Partition construction shall supply an STC rating of 44 or better. Provide suspended painted wallboard for the ceiling finish and lighting format. The ceiling heights shall be 8'-0" above the finished floor. Provide accessories, shelves for hand-carried items and hooks for clothing.

### 3.2.1.7.20 Equipment Rooms

Provide equipment room entry doors with locksets (coordinate the keying of these spaces with the Installation groups responsible for maintenance and operation). This will be particularly important for the equipment room that houses the special recording equipment for the counseling functions in the CFLC. Provide exposed concrete for the floor finish, resilient base for the wall/floor trim, and painted wallboard for the wall finish. Partition construction shall supply an STC rating of 44 or better. Provide suspended painted wallboard or exposed structure for the ceiling finish and lighting format. The ceiling height shall be as appropriate to the space and equipment.

### 3.2.1.7.21 Exterior Canopy Areas

Provide exterior canopies at each entrance with a weather, insect, bird, and vermin resistant ceiling material. Minimum height of canopy ceiling shall be 9'-0". Provide paved surface below with decorative accent and slip-resistant finish.

## 3.2.2 SITE PLANNING AND DESIGN

If this facility is not located a minimum of 148-feet from the perimeter of the Installation and 82-feet from trash containers, roadways and parking lots, provide hardened construction as described in UFC 4-010-01. Adjust the facility orientation on the selected site to take advantage of desirable views and according to recognized design principles. Provide screen walls and other site features where directed in other paragraphs. Screen walls should generally be a minimum of 6'-0" in height. Screen walls should allow for a 3'-0" space around the container and the wall. Provide a screened area size sufficient to allow 2'-0" between containers where more than one being housed. Provide planting to integrate screen walls into the site. Provide retaining walls (if/where necessary) that visually coordinate with building wall materials. Provide sidewalk arrangements that include a 2'-0" wide (or more) planting strip between the walkways and vehicular pavement. Provide a bus/shuttle/waiting-for-a-ride shelter on a concrete pad placed well with the sidewalk system and so that the shelter front is set back from the sidewalk path at least 3'-0". Provide bicycle racks adjacent to parking areas and sidewalks (as opposed to being close to building entrances).

## 3.2.3 SECURITY

The element of UFC 4-010-01 that has the most significant impact on project planning is providing protection against explosives effects. That protection can either be achieved using conventional construction (including specific window requirements) in conjunction with establishing relatively large standoff distances to parking, roadways, and installation perimeters or through building hardening, which will allow lesser standoff distances. Even with the latter, the minimum standoff distances cannot be encroached upon. These setbacks will establish the maximum buildable area. All standards in Appendix B of UFC 4-010-01 (8 October 2003, including Change 1 dated 22 Jan 2007) must be followed. In addition to the UFC cited in this paragraph UFC 4-020-02FA, (2005) Security Engineering: Concept Design; UFC 4-020-03FA, (2005) Security Engineering: Final Design; UFC 4-020-04FA, (2005) Electronic Security Systems: Security Engineering; and UFC 4-021-01, (9 April 2008) Mass Notification Systems also apply to the facility.

## 3.2.4 ARCHITECTURE AND INTERIOR DESIGN

### 3.2.4.1 Architecture

Provide an exterior appearance and massing that coordinates with the plan of the facility. The Architectural theme of the facilities will match the requirements of Paragraph series 6.5. Also see Appendix F. Provide almost all (toilets and locked equipment rooms are an obvious exception) interior doors with a narrow glazed view lite. Provide appropriate exterior windows for all appropriate spaces. Window sizes and placement are to integrate with the exterior design theme. Provide window area of a minimum of 10 percent of the exterior wall area below 10 feet above the finished floor. Clerestory windows would be appropriate for the gymnasium if they work well with other aspects of the offerer's proposal. Provide a roof slope of at least 3 in 12 for all areas of roofing and snow guards over entrances or other features requiring protection along eave edges of low-friction roofing such as metal. Analyze the acoustics of the Activity Center, and the Gymnasium Multi-Purpose room in relation to the A/V System and providing optimum ability for congregations to hear presenters clearly.

### 3.2.5.1 Interior Design

#### 3.2.5.1.1 Interior Building Appearance

The facility interior shall be a warm, comfortable, and professional environment through the appropriate use of building

materials, furniture, finishes, fabrics, color, texture, and the generous use of wood. Materials and features shall be of high quality, functional, easily maintained and furnished as described herein. In regions where similar materials such as natural stone tiles or other special flooring tiles are competitive in price and provide the same appearance and performance characteristics, these materials are also generally acceptable wherever porcelain tile is specifically called for herein. Building finishes and details and furniture style, finish and fabrics shall be complementary and provide a completely coordinated interior design. The interior building appearance shall coordinate with the exterior building appearance. Consider spaces that open up to one another when selecting furniture and building finish and color selections. The criteria within this document identifies the level of quality and special requirements for finishes and furniture, yet provides flexibility for the designer to make creative and appropriate selections to meet User requirements. Dimensions provided are approximate.

#### 3.2.5.1.2 Window Treatment

Provide horizontal blinds for all exterior windows, with the exception of windows at building entrances. Provide drapery at the raised platform in the Activity Center. Drapery fabric and fabrication shall be appropriate for the intended use and location.

#### 3.2.5.2 Signage

Provide electrical conduits and communication conduits for a lighted and substantial (masonry or aluminum support structure, message board insert, etc. are possible components, coordinate with the garrison) exterior building sign at an appropriate area on the site. Provide an exterior way-finding signage system that addresses each of the buildings (and some primary spaces) in the complex that will provide directions for people arriving on site that park in the shared lots or on foot and desire to proceed to a specific location. Provide a complete interior signage system that coordinates with the interior design. The facility interior signage system shall be standardized throughout the building and shall be flexible to allow for the addition and deletion of signs and information. Room signs and building directory shall be provided. Directories shall be located in the primary lobbies and at a minimum shall identify the location of the Counseling Suite, Activity Center, Administrative Suite, Graphic Arts/Sculpture/Craft Classroom, Restrooms, and Gymnasium Multi-Purpose Room.

#### 3.2.5.3 Miscellaneous Building Items

3.2.5.3.1 Provide entry mats at all entry vestibules and lobbies. Entry mats shall be of the shallow built-in type, be classified for heavy commercial use and be of dirt-hiding construction.

3.2.5.3.2 Not Used.

3.2.5.3.3 Provide one marker board in each classroom (except where presentation boards are placed). Marker boards shall be wall mounted with a marker tray. Dry erase markings on marker board shall be removable with a felt eraser or dry cloth. Marker board size shall be 4-feet wide x 3-feet high.

3.2.5.3.4 Provide two enclosed bulletin boards in the Primary Lobby. Bulletin board shall have lockable safety glass doors. Size shall be 5-feet wide x 2-feet-6-inches high.

3.2.5.3.5 Provide three presentation boards in the Counseling, Conference rooms, or Classroom as selected by the local Chaplains. Presentation board shall be of the wall hung wood cabinet type with doors. Inside there shall be a marker board writing surface with marker tray and projection screen. Presentation board size shall be 4-feet wide x 3-feet high.

3.2.5.3.6 Not Used.

3.2.5.3.7 Provide one pre-manufactured unit specifically designed for diaper changing for each of the group restrooms and the larger counseling room. The unit shall be wall mounted and designed to self-store up against the wall it is mounted on when not in the open position. Unit shall have safety features normally required for this type of unit. Depth in the closed position shall be 3-inches.

3.2.5.4 Not Used

3.2.5.5 Furniture



The furniture in this category is to be Government Furnished/Government Installed. Furniture shall not have sharp edges. Clips, screws, and other furniture construction elements shall be concealed where possible. Upholstery in office areas and lounge furniture shall meet Wyzenbeek Abrasion Test; 50,000 minimum double rubs. Furniture can be wood, plastic laminate or metal finish, coordinate requirements with the User. Preferred top for wood furniture is plastic laminate that closely matches adjacent wood and mitered solid wood edge. Glass tops shall be provided for furniture with wood tops. Tops for case goods with plastic laminate or metal construction shall be plastic laminate. Location, use, and frequency of moving furniture shall be considered when determining appropriate finish material and construction. Furniture constructed of particleboard with plastic laminate finish is not acceptable. Box and file drawers shall have a heavy-duty suspension system. Furniture shall be constructed with concealed fasteners. Furniture storage shall be lockable. Style details and finishes shall be coordinated in a room. Furniture finishes and fabrics shall be appropriate for intended use. Upholstery fabric (color, pattern and fiber content) shall be easily cleaned and help hide soiling. Patterned fabrics are recommended for seating. Quantities required are listed in parenthesis behind furniture code.

The Furniture, Fixtures and Equipment (FF&E) shall consist of two furniture packages. Packages One and Two shall comply with requirements identified in Section 01 33 16 Design After Award. Furniture plan for Package One and Two can be the same, but shall clearly identify what is included in each package.

### **CFLC AND MPAC FURNITURE AND EQUIPMENT (FF&E) LIST**

#### **Package One: (Sizes listed are approximate)**

**Item S01,** Ergonomic Desk Chairs With Arms, separate upholstered cushioned seat and back, back tilt and locking capability, pneumatic seat height adjustment, back height adjustment, seat depth adjustment, five star base on casters (2'-0" w x 2'-2" d x 2'-8" to 3'-2" h) for the Offices

**Item S03,** Guest Chairs With Arms, upholstered cushioned seat and back, style shall complement the desk and task chairs (1'-9" w x 1'-11" d x 2'-6" h), for the Offices

**Item S04,** Fully Upholstered Lounge Chair with enclosed arms. Armrests and legs/base may be wood, frame shall be solid hardwood with all parts glued and fastened (2'-7" w x 2'-7" d x 2'-9" h), for the Lobby reception spaces, Group Office, Meditation/Reconciliation

**Item S06,** Stacking Chairs with sled base and glides. Glides shall be appropriate for floor finish. Frame shall be solid base stock with chrome plate or durable color finish. Polypropylene or steel seat and back (1'-7" w x 1'-11" d x 2'-7" h for the back and 1'-6" h for the seat). Provide chair dollies (30-50 chair capacity) for these chairs of a type that shall fit through single swinging doorways when fully loaded, for the Classrooms, Multi-Purpose Rooms

**Item S07,** Stacking Chair Dollies appropriate to the chairs and the storage space allotted, for the chair storage

**Item S08,** Upholstered Folding Chairs (metal) with upholstered seat and back cushions. Provide sufficient chair dollies for these chairs of a type that shall fit through single swinging doorways and through doors under Activity Center Raised Platform when fully loaded, for the Expansion Area/Classroom, Activity Center, and Activity Center Raised Platform

**Item S09,** Upholstered Folding Chair Dollies appropriate to the chairs and the storage space allotted, for the chair storage

**Item D01,** Double Pedestal Desk with center pencil drawer and modesty panel. Desk size shall be 5'-0" w x 2'-6"

**Item D02,** U-Shaped Workstation with left return shall have a primary work surface supported by a pedestal; desk height return with adjustable keyboard tray and mouse attachment; and secondary work surface with pedestal. Unit shall also have lockable overhead storage, tackboard, and task light under all overhead storage, modesty panels and pencil drawer. The size of the primary work surface shall be 5'-10" w x 2'-6" d. The size of the return shall be 3'-5" w x 2'-0" d. The size of the secondary work surface shall be 5'-10" w x 1'-8" d

**Item D03,** L-Shaped Workstations with primary work surface supported by a pedestal; a desk height return with adjustable keyboard tray and mouse attachment; and a secondary work surface with pedestal. Storage shall be lockable. Unit shall also have lockable overhead storage, tackboard, and task light under all overhead storage, modesty panels and pencil drawer. The size of the primary work surface shall be 5'-10" w x 2'-6" d, of the return shall be 3'-5" w x 2'-0" d, of the secondary work surface shall be 5'-10" w x 1'-8" d

**Item D04,** Five-Shelf Bookcases with 4 adjustable shelves (3'-0" w x 1'-3" d x 5'-6" h)

**Item D05,** Two Drawer Lateral File Cabinets (2'-6" w x 1'-8" d x 2'-5" h)

**Item D07,** L-Shaped Workstation with primary work surface, pencil drawer and pedestal; desk height return with pedestal, adjustable keyboard tray and mouse attachment. Unit shall also have lockable overhead storage, tackboard, and task light under all overhead storage. The size of the primary work surface shall be 5'-10" w x 2'-6" d, of the return shall be 3'-5" w x 2'-0" d

**Item T01,** Multi-Purpose Tables designed for heavy use, be adjustable in height, and have folding legs with automatic locking leg feature. Tables shall be relatively lightweight and have easy to clean surfaces. All working parts shall be recessed behind an apron. Top surface and edge treatment shall withstand heavy use. Size shall be 6'-0" w x 2'-6" d x 1'-8" h to adjust to 2'-6" h

**Item T06**, Small Conference Table. Stationary table with leg structure of 16 gauge steel tubing with glides. Top surface and edge treatment shall withstand heavy use. Table size shall be 2'-6"w x 2'-4 1/2"

**Item T03**, Table Dollies. Dolly type, size and quantity shall transport and store the required number of tables. Fully loaded dolly shall be capable of being maneuvered within the facility, fit through a singlewide door, and through doors under Activity Center Raised Platform, for the table storage

**Item T05**, End Tables with detailing and finish to match seating and other furnishings in rooms. Tabletop shall be easily cleaned and maintained. Size shall be 1'-11"w x 1'-11"d x 1'-10"

**Item A01**, Small Trash Receptacle, minimum 28 quart capacity, provide quantity appropriate for use

**Item A02**, Large Trash Receptacle, minimum 12 gallon capacity, provide quantity appropriate for use

**Item E01**, Refrigerator, automatic defrost 0.4 cubic meters top freezer 2 doors, 5'-2"h x 2'-3"d x 2'-3"w

**Item E02**, Range, Single Oven, four surface burners, viewing window, commercial grade 2'-5 1/2"w

**Item E03**, Dishwasher, 2'-0"w

**Item E04**, Piano, 6'-0" Grand Piano

#### **Package Two (Sizes listed are approximate)**

**Item S10**, small stackable children's chairs with easily maintainable finishes, heavy-duty construction. For preschool through 2<sup>nd</sup> grade (1'-4"w x 1'-4"d x 2'-0"h for the back and 1'-2"h for the seat)

**Item T02**, children's tables designed for heavy use, be adjustable in height, and have folding legs with automatic locking leg feature. Tables shall be relatively lightweight and have easy to clean surfaces. All working parts shall be recessed behind an apron. Top surface and edge treatment shall withstand heavy use. Size shall be 6'-0"w x 2'-6"d x 1'-8"h to adjust to 2'-6"h

#### **Family Life Center Furniture Requirements:**

Counseling Classroom/Conf Library: T06 - 2, S06 - 16

Group Counseling Office: S01 - 1, D05 - 1, T05 - 1, S04 - 4, S01 - 1, S03 - 2

Counseling and Waiting/Lounge Rooms: S04 - 3, T05 - 1

Offices: D03 - 1, D05 - 1, S01 - 1, S03 - 2

Administration Area Largest Office: D02 - 1, T06 - 1, D04 - 1, D05 - 3, S01 - 1, S03 - 6

Reception/Waiting Areas: D03 - 1, D05 - 1, S01 - 1, S03 - 3, T05 - 1

Resource Center: D01 - 1, S01 - 1

Small Classrooms: T01 - 1, S06 - 8

Larger Classrooms: T01 - 2, S06 - 16

Small Classrooms on West Side of Building: T01 (Smaller size to seat 4) - 1, S06 - 4, D01 - 1, S01 - 1

Larger Classrooms on West Side of Building: T01 - 1, S06 - 8, D01 - 1, S01 - 1

Classroom to be used for Child Care: appropriate quantity of T02 and S10 and adequate storage units

Kitchen: E01 - 1, E02 - 1, E03 - 1

Raised Platform: E04 - 1, appropriate quantity of T03 and S09

Activity Center: Layout with chairs, S08 - 180, Layout with tables and chairs, S08 - 120, T01 - 20 (Total number of S08 chairs required for this room is 180)

#### **Multipurpose Activity Center Furniture Requirements:**

Offices: D03 - 1, D05 - 1, S01 - 1, S03 - 2

Arts and Crafts: Appropriate quantity per room size of S08 and T01, and adequate storage units for supplies and art work

Youth Lounge/Interaction Center: Appropriate quantity per room size of S04 and T05, T01 (smaller size to seat 4) - 1, S06 - 4

### **3.2.5 STRUCTURAL DESIGN**

A wide variety of structural systems may prove suitable for this facility. The design of structural systems shall be based upon applicable criteria. The foundation system shall be designed according to site specific soil conditions which will require a geotechnical site investigation. The local availability of building materials may be the deciding factor on the type of structural systems chosen. The longer than normal spans in the large seating areas and the support of movable partitions are two aspects of the design that must be given careful consideration.

#### **3.2.4.1 Structural loading criteria**

See paragraph 3 for facility specific (if applicable) and paragraph 6 for site and project specific structural loading criteria.

#### **3.2.4.2 Wind Exposure Category**

Unless otherwise specified in paragraph 6, use Exposure Category C for wind. If not specified, use Category C unless the Designer of Record can satisfactorily justify another Exposure Category in its design analysis based on the facility Master Plan. Submit such exceptions for approval as early as possible and prior to the Interim Design Submittal in Section "Design After Award."

#### 3.2.4.3 Floor Live Loads for Arts & Crafts Room

The live load used for design of second floor framing for the Arts & Crafts Room shall include the weight of the kiln, in addition to usual floor live loads..

### 3.2.6 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

#### 3.2.6.1 General

The facility shall normally be air conditioned except that the storage and service areas may be ventilated and heated as required by code. The Kitchen shall be cooled not to exceed 85 degrees Fahrenheit and heated to maintain temperature no less than 68 degrees Fahrenheit. The janitor closet and Restrooms shall maintain a negative pressure related to adjacent areas. Mechanical rooms shall accommodate space for equipment maintenance access without having to remove other equipment. Mechanical, electrical and telecommunications rooms shall be keyed separately for access by Installation maintenance personnel and fire department.

With the exception of exhaust fan dedicated for restrooms and janitor closet, all primary and intermediate equipment of the HVAC, and plumbing system shall be provided in the mechanical equipment room. Air tempering equipment dedicated to provide zone control to different essential areas shall be scattered around the mezzanine. Accessibility for future maintenance to the mechanical equipment shall be taken in account in the design and selection of all mechanical equipment.

#### 3.2.6.2 Heating Ventilating and Air Conditioning Design

Heating Ventilating and Air Conditioning Design will be based on geographical location, climate and applicable criteria listed on this section.

#### 3.2.6.3 Mechanical Systems

Selection of energy sources and mechanical systems shall be based on local availability and Life Cycle Cost. In addition, all mechanical system design and selection shall comply with the requirements of applicable criteria listed in this section.

#### 3.2.6.4 Features and Controls

All mechanical systems, including the ductwork, grills and diffusers shall be well concealed from inhabited spaces. Coordinate such that concealed shafts or pathways are provided where mechanical systems require them. Outdoor intake and return louvers shall be designed in such a way that general public access to these components is restricted. Controls shall be easily accessed by staff but relatively secure from the general public. This facility will be used in many different ways. Some spaces will be filled to capacity at the same time that other spaces will be empty. For spaces where the number of occupants varies from just a few to a large number (such as the Activity Center and Gymnasium Multi-Purpose Room), consideration should be given to the use of CO2 sensors to control the amount of outside air to the space, based on the actual need in lieu of the amount of outside air needed for maximum occupancy during all occupied hours. This would also provide for an energy efficient warm-up or cool-down mode prior to occupancy.

#### 3.2.6.5 Zoning

Provide carefully considered zoning to accommodate the optimum number of use combinations. Zoning shall be separated by internal and external areas with respect to wall exposed to solar radiation. Zones separation shall be also based on systems isolation and operation. Air handling system serving the Activity Centers requires individual zone control. Other areas such as the Classrooms, shall be served by systems that will provide individual temperature control in each space and should provide for economy of operation when only a few of these spaces are occupied.

#### 3.2.6.6 Acoustics

Acoustics is an important consideration in the design of chapels. Therefore, mechanical equipment items placed outside and adjacent to the building shall require screening and appropriate acoustic control. Also ensure that operating noises do not

intrude into inhabited areas. Designer shall design the air distribution less or equal 20 NC. Access clearances for servicing and proper airflow shall be provided when developing the screening and acoustic control.

#### 3.2.6.7 Energy Monitoring and Control Systems

An energy management system with override capacity accessible to the user shall be provided. Tie the UMCS into the existing system using IT connection. Transmit water meter reading to the existing UMCS via radio. See Appendix AA for additional water, gas, and power meter requirements.

#### 3.2.7 PLUMBING

Underground and aboveground domestic water supply, storm, sanitary sewers and gas distribution are required. Toilet facilities, kitchen and floor drains make up the majority of the plumbing requirements in this facility. A domestic hot water heater for the kitchen and sinks shall be provided. Gas will be required where feasible and available as main source of heating for domestic hot water heaters and boilers.

#### 3.2.8 FIRE PROTECTION

Fire suppression systems will be designed in accordance with the latest edition of UFC 3- 600-01. The majority of the facility will be classified as Assembly, except that mechanical rooms, electrical rooms, storage rooms, and janitor's rooms will be ordinary hazard – group 1. The facility shall be protected throughout by a complete automatic sprinkler system. Fire alarm systems shall be addressable type with addressable devices. The type, function and location of the fire alarm annunciator shall be coordinated with the local authority having jurisdiction. Provide an annunciator panel at each entrance to the building.

##### 3.2.8.1 Standards and Codes

All fire protection and life safety features shall be in accordance with UFC 3-600-01 and the criteria referenced therein.

##### 3.2.8.2 Qualification

The Fire Protection Engineer shall meet the conditions indicated in the UFC 3-600-01.

##### 3.2.8.3 Fire Protection and Life Safety Analysis

A fire protection, building code and life safety analysis shall be provided for all buildings in this project. This analysis shall be submitted in accordance with the provision described in section 01 33 00 Submittal Procedures and UFC 3-600-01. Fire protection and Life Safety Code analysis should include all the information outlined in Attachment D, section 01 33 16 as minimum requirements.

##### 3.2.8.4 Sprinkler System

Provide complete sprinkler protection where required by the UFC 3-600-01. Sprinkler protection shall be designed in accordance with UFC 3-600-01, NFPA 13 and all other applicable criteria listed in paragraph 4 of this section. Wet pipe sprinkler systems shall be provided in all heated areas and dry pipes sprinkler systems shall be provided in areas subject to freezing.

###### 3.2.8.4.1 Sprinkler Service Main and Riser

Sprinkler service mains shall be dedicated lines from the distribution main. Do not combined sprinkler service piping and domestic service piping. Sprinkler service mains shall be provided with an exterior post indicating valve with tamper switch reporting to the fire alarm control panel (FACP). Underground fire service pipe penetrating floors shall be provided with a pipe sleeve. The sprinkler riser shall include a double backflow preventer, a remote fire department connection and a wall hydrant for testing of backflow prevention assembly. The sprinkler system shall include an indicating control valve for each sprinkler riser, a flow switch reporting to the FACP, and an exterior electric alarm bell.

###### 3.2.8.4.2 Backflow Preventer

An exterior wall hydrant with dual hose connections with OS&Y valve shall be provided to allow testing of the backflow preventer.

#### 3.2.8.4.3 Fire Department Connection

A fire department connection shall be provided for each building provided with a suppression (sprinkler) system. The location shall be accessible by the fire department, shall be unobstructed, and shall be within 150 feet from the nearest fire hydrant.

#### 3.2.8.4.4 Fire Pump

The requirement for a fire pump shall be determined by the Contractor based on fire flow data from the project site and fire protection system design for the project. If required, a complete fire pump design and installation shall be provided for the facility. Fire pump design and installation shall comply with the requirements of UFC 3-600-01 AND NFPA 20.

#### 3.2.8.4.5 Sprinkler System Materials and Components

Materials and components for sprinkler systems and fire pumps shall be in accordance with UFC 3-600-01, NFPA 13 and NFPA 20. Sprinkler head type shall be quick response (wet pipe system only). Piping shall not be exposed in finished areas.

#### 3.2.8.4.6 Area of Demand, Design Density and Exterior Hose Stream

Area of demand, design densities and exterior hose stream shall be in accordance with UFC 3-600-01, table 4-1.

#### 3.2.8.4.7 Fire Water Supply

Fire flow data is provided in appendix D for bidding purpose.

#### 3.2.8.5 Kitchen

Range shall be provided with a wet chemical suppression system and automatic shut-off for electric or gas fuel sources. Design shall conform to UFC-3-600-01. Provide appropriate fire extinguisher and cabinet in the kitchen area.

#### 3.2.8.6 Fire Extinguisher Cabinets

Fire extinguisher cabinets shall be provided where fire extinguishers are required by UFC 3-600-01 and NFPA 101. Provide semi-recessed cabinets in all finished areas. Travel distance to/from the extinguisher cabinets shall not exceed that required by NFPA 10. Fire extinguisher cabinets shall be capable of housing a 10 lb ABC portable fire extinguisher. Fire extinguisher door panels shall not be locked. Provide appropriate fire extinguisher and cabinet in the kitchen area.

#### 3.2.8.7 Fire Detection and Alarm Systems.

Fire alarm system shall be addressable type with addressable devices. Type, function and location of the fire alarm annunciation panel shall be located at the entrance to each building. For additional information refer to Electrical and Communication paragraphs in this section.

#### 3.2.9 MASS NOTIFICATION

The mass notification system shall be designed in accordance with UFC 4-021-01.

#### 3.2.10 ELECTRICAL SYSTEMS

##### 3.2.10.1 General

Lighting for this facility shall be according to all applicable criteria and shall take into consideration the functional needs of the spaces. This, along with fans and fractional horsepower motors, will make up the majority of the electrical loads for the facility.

##### 3.2.10.2 Lighting Requirements

Lighting for most spaces with suspended acoustic ceilings shall be of the recessed type. Lighting for the Activity Center, Gymnasium Multi-Purpose Room and the Atrium Lobby shall receive special attention as to color accents in lighting, fixture type, and flexibility. Creative lighting techniques are encouraged. High lighting shall include some accommodation for maintenance and the changing of lamps. A dimming system shall be installed to control the Activity Center and Gymnasium Multi-Purpose Room lighting. The dimming system shall be capable of controlling lighting down to 1%, and shall have a minimum 3 presets. All illumination levels shall be maintained illumination levels per IESNA recommendations. Lighting in the Gymnasium Multi-Purpose Room shall have protective fixtures to prevent breakage from basketballs, volleyballs, etc.

### 3.2.10.3 Power Requirements

#### 3.2.10.3.1 Mechanical Equipment

Requirements for heating, ventilation, and air conditioning system shall be determined by the project criteria package. Heating, ventilation, and air conditioning system may be distributed into several smaller units through out the building because of difficulty in running duct systems through the building. Mechanical and Electrical rooms shall be separate rooms. Each room shall have exterior access. Mechanical / Electrical rooms are not to be used for any other purpose unless agreed to by the appropriate mechanical / electrical designers. All exterior on-grade mechanical and electrical equipment shall be located within an enclosed area. Access around equipment shall be provided for service and air flow. In cold climates provide features that will protect plumbing, water lines, and other lines from freezing.

#### 3.2.10.3.2 Support Facilities

Raised Platforms will require recessed power outlets and outlets for wired microphones. Power outlets and microphone outlets will be located in close proximity to give the maximum amount of flexibility.

#### 3.2.10.3.3 Miscellaneous Equipment

Contractor shall provide power for all CFCI and GFGI equipment that is identified in this document. This equipment includes, but is not limited to, ranges with ovens, full size refrigerators, stand-alone ice-makers, automatic dishwashers, garbage disposals, and microwaves in the kitchen.

#### 3.2.10.3.4 Kitchen

Countertop outlets shall be provided per NEC 210.52 for kitchens. Countertop outlets shall be served by a minimum of 3 circuits.

#### 3.2.10.3.5 Child Care

Any rooms identified to have child care features shall have tamper resistant receptacles installed.

### 3.2.11 TELECOMMUNICATION

#### 3.2.11.1 Audio-Visual (A/V) System

##### 3.2.11.1.1 General

Provide a complete A/V System design, including a component list with brands, models, pricing, and a detailed functional description of how the system is intended to operate. This A/V system shall be a high quality, fully integrated audio-visual system for the facility that allows for all currently common media activities including the ability to integrate DVD, VCR, private and commercial television broadcasts. The system shall have some ability to be controlled by portable computer. The system may consist of component sub-systems, so long as all are fully integrated for operation throughout the facility. The system shall have the ability to transmit separate media to the Activity Center, the Gymnasium Multi-Purpose Room, and each Classroom. The system shall also have the ability to allow the Activity Center, the Gymnasium Multi-Purpose Room

and the classrooms to function together and share a single media presentation. From this A/V System design, also provide a complete supporting raceway system in the construction.

#### 3.2.11.1.2 Control

The “primary” control point for the A/V system shall be located in the CFLC Activity Center in a CFCI lockable media control console at the rear of the space, fully set up to control all media items and equipment. This console shall be shaped to be as shallow as possible and be attached to the back wall opposite the restrooms. Provide additional control points for the A/V system in the following locations:

In the Activity Center:

- a. Near the center-rear of the raised platform

All secondary control points shall have basic control functions for on/off/volume-of-each-speaker-grouping-in-the-space/microphone-on-off. Each secondary control point shall also have inputs points for a portable type computer and television quality camera. In rooms with operable projector mounts, the secondary control shall be able to raise and lower each projector. Each secondary control point shall have a lockable cover and be integrated into the supporting features. The control housing at the Worship Center raised platform shall be supported by a furniture quality shallow wall-mounted cabinet.

#### 3.2.11.1.3 Input

The system shall be able to process input from all microphones, musical instruments as defined, portable computers, and television cameras. Provide connections/accommodations for wired and wireless, hand-held, mounted, lapel clip and belt clip types of microphones. The contractor shall provide a minimum of 8 plug-in type microphone connection points along the middle and rear edge of the raised platform in the Activity Center. Contractor shall also provide CATV input to the A/V system.

#### 3.2.11.1.4 Output

##### 3.2.11.1.4.1 Speakers

The system shall include a low-level distribution loudspeaker system that provides uniformity of coverage between the frequencies of 100-1,200 Hertz. The system shall be capable of producing an intelligible signal at a minimum of 75 dB throughout the spaces. Speakers may be wall and/or ceiling mounted. Speakers shall have volume-on-off control. Contractor may install volume control at each speaker, or have one control per room. Speaker arrays shall be designed for and located in the following rooms: Activity Center, Gymnasium Multi-purpose Room, Offices, Kitchen, Resource Center, Lobbies, and Restrooms.

##### 3.2.11.1.4.2 Projectors

The system shall include LCD projectors. The Activity Center shall have two (2) permanently mounted LCD projectors on fixed projector mounts facing the screens in this area. The Gymnasium Multi-Purpose Room shall two (2) permanently mounted LCD projectors on operable projector mounts that allow for raising and lowering the projectors. One (1) of the Activity Center projectors shall face the screen at the raised platform, and one (1) facing the screen on the opposite wall. The Gymnasium Multi-Purpose Room shall have one (1) permanently mounted LCD projector on an operable projector mount that allows for raising and lowering of the projector. One (1) of the Gymnasium Multi-Purpose Room projectors shall face the screen at the raised platform, and one (1) facing the screen on the opposite wall. The classrooms will have one (1) wall mounted connection point for a portable LCD projector.

#### 3.2.11.1.5 Certifications

The system shall be National Systems Contractors Association (NSCA) certified with R-ESI credentials for the system coordinator and C-EST credentials for the installing staff.

### 3.2.11.2 Community Antenna Television (CATV)

A CATV system shall be installed in accordance with the Technical Guide for Installation Information Infrastructure Architecture (I3A). A minimum of one (1) CATV outlet shall be located in the following rooms: Activity Center, Gymnasium Multi-Purpose Room, offices, classrooms, and Resource Center.

### 3.2.11.3 Telephone and Data

Telephone and data outlets shall be installed in accordance with the Technical Guide for Installation Information Infrastructure Architecture (I3A), with the following exceptions. All offices and classrooms and the Resource Center shall have a minimum two (2) combination telephone and data outlets available for workstations. The Kitchen shall have a minimum of one (1) combination telephone and data outlet.

### 3.2.11.5 Public Address (PA) System

The contractor shall make provisions to connect the phones to the A/V System audio for use as a PA System.



#### 4.0 APPLICABLE CRITERIA

Unless a specific document version or date is indicated, use criteria from the most current references as of the date of issue of the contract or task order, including any applicable addenda, unless otherwise stated in the task order. In the event of conflict between References and/or Applicable Military Criteria, apply the most stringent requirement, unless otherwise specifically noted in the contract or task order.

##### 4.1. INDUSTRY CRITERIA

Applicable design and construction criteria references are listed in Table 1 below. This list is not intended to include all criteria that may apply or to restrict design and construction to only those references listed. See also Paragraph 3 for additional facility-specific applicable criteria.

**Table 1: Industry Criteria**

<b>Air Conditioning and Refrigeration Institute (ARI)</b>	
ARI 310/380	Packaged Terminal Air-Conditioners and Heat Pumps
ARI 440	Room Fan-Coil and Unit Ventilator
ANSI/ARI 430-99	Central Station Air Handling Units
ARI 445	Room Air-Induction Units
ARI 880	Air Terminals
<b>Air Movement and Control Association (AMCA)</b>	
AMCA 210	Laboratory Methods of Testing Fans for Rating
<b>American Architectural Manufacturers Association (AAMA)</b>	
AAMA 605	Voluntary Specification Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
AAMA 607.1	Voluntary Guide Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum
AAMA 1503	Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections
<b>American Association of State Highway and Transportation Officials (AASHTO)</b>	
	Roadside Design Guide [guardrails, roadside safety devices]
	Standard Specifications for Transportation Materials and Methods of Sampling and Testing [Road Construction Materials]

	Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals
	Guide for Design of Pavement Structures, Volumes 1 and 2 [pavement design guide]
	A Policy of Geometric Design of Highways and Streets
<b>American Bearing Manufacturers Association (AFBMA)</b>	
AFBMA Std. 9	Load Ratings and Fatigue Life for Ball Bearings
AFBMA Std. 11	Load Ratings and Fatigue Life for Roller Bearings
<b>American Boiler Manufacturers Association (ABMA)</b>	
ABMA ISEI	Industry Standards and Engineering Information
<b>American Concrete Institute</b>	
ACI 302.2R	Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials
ACI 318	Building Code Requirements for Structural Concrete
ACI SP-66	ACI Detailing Manual
ACI 530	Building Code Requirements for Masonry Structures
<b>ADA Standards for Accessible Design</b>	
See US Access Board	ADA and ABA Accessibility Guidelines for Buildings and Facilities, Chapters 3-10.
<b>American Institute of Steel Construction (AISC)</b>	
	Manual of Steel Construction – 13 <sup>th</sup> Edition (or latest version)
<b>American Iron and Steel Institute</b>	
AISI S100	North American Specification for the Design of Cold-Formed Steel Structural Members
<b>American National Standards Institute 11 (ANSI)</b>	

ANSI Z21.10.1	Gas Water Heaters Vol. 1, Storage water Heaters with Input Ratings of 75,000 Btu per Hour or less
ANSI Z124.3	American National Standard for Plastic Lavatories
ANSI Z124.6	Plastic Sinks
ANSI Z21.45	Flexible Connectors of Other Than All-Metal Construction for Gas Appliances
ANSI/IEEE C2-2007	National Electrical Safety Code
ANSI/AF&PA NDS-2001	National Design Specification for Wood Construction
<b>American Society of Civil Engineers (ASCE)</b>	
ASCE 7	Minimum Design Loads for Buildings and Other Structures
ASCE 37	Design and Construction of Sanitary and Storm Sewers, Manuals and Reports on Engineering Practice [sanitary sewer and storm drain design criteria]
ASCE/SEI 31-03	Seismic Evaluation of Existing Buildings [Existing Building Alteration/Renovation]
ASCE/SEI 41-06	Seismic Rehabilitation of Existing Buildings [Existing Building Alteration/Renovation]
<b>American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)</b>	
ASHRAE 90.1	ANSI/ASHRAE/IESNA 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE Guideline 0	The Commissioning Process
ASHRAE Guideline 1.1	The HVAC Commissioning Process
ASHRAE Handbooks	Fundamentals, HVAC Applications, Systems and Equipment, Refrigeration (Applicable, except as otherwise specified)
ASHRAE Standard 15	Safety Standard for Refrigeration Systems
ASHRAE Standard 62.1	Ventilation for Acceptable Indoor Air Quality
ASHRAE Standard 55	Thermal Environmental Conditions for Human Occupancy

<b>American Society of Mechanical Engineers International (ASME)</b>	
ASME BPVC SEC VII	Boiler and Pressure Vessel Code: Section VII Recommended Guidelines for the Care of Power Boilers
ASME A17.1	Safety Code for Elevators and Escalators
ASME B 31 (Series)	Piping Codes
<b>American Water Works Association (AWWA)</b>	
	Standards [standards for water line materials and construction]
<b>American Welding Society</b>	
	Welding Handbook
	Welding Codes and Specifications (as applicable to application, see International Building Code for example)
<b>Architectural Woodwork Institute (AWI)</b>	
Version 1.2	AWI Quality Standards 7th Edition
<b>Associated Air Balance Council (AABC)</b>	
AABC MN-1	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems
	AABC Associated Air Balance Council Testing and Balance Procedures
<b>ASTM International</b>	
ASTM C1060-90(1997)	Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings
ASTM E 779 (2003)	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
ASTM E1827-96(2002)	Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door
<b>Builders Hardware Manufacturers Association (BHMA)</b>	
ANSI/BHMA	American National Standards for Builders Hardware

<b>Building Industry Consulting Service International</b>	
	Telecommunications Distribution Methods Manual (TDMM)
	Customer-Owned Outside Plant Design Manual (CO-OSP)
<b>Code of Federal Regulations (CFR)</b>	
49 CFR 192	Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards
10 CFR 430	Energy Conservation Program for Consumer Products
<b>Consumer Electronics Association</b>	
CEA 709.1B	Control Network Protocol Specification
CEA 709.3	Free-Topology Twisted-Pair Channel Specification
CEA 852	Tunneling Component Network Protocols Over Internet Protocol Channels
<b>Electronic Industries Association (EIA)</b>	
ANSI/EIA/TIA 568	Structured Cabling Series
ANSI/EIA/TIA 569	Commercial Building Standard for Telecommunications Pathways and Spaces (includes ADDENDA)
ANSI/TIA/EIA-606	Administrative Standard for the Telecommunications Infrastructure of Commercial Buildings
J-STD EIA/TIA 607	Commercial Building Grounding and Bonding Requirements for Telecommunications
<b>Federal Highway Administration (FHWA)</b>	
	Manual on Uniform Traffic Control Devices for Streets and Highways [signage and pavement markings for streets and highways]
FHWA-NHI-01-021	Hydraulic Engineering Circular No. 22, Second Edition, URBAN DRAINAGE DESIGN MANUAL
<b>Illuminating Engineering Society of North America (IESNA)</b>	
IESNA RP-1	Office Lighting

IESNA RP-8	Roadway Lighting
IESNA Lighting Handbook	Reference and Application
<b>Institute of Electrical and Electronics Engineers Inc. (IEEE)</b>	
	Standard for Use of the International System of Units (SI): the Modern Metric System
Standard 1100	Recommended Practice for Powering and Grounding Sensitive Electronic Equipment
<b>International Code Council (ICC)</b>	
IBC	<p>International Building Code</p> <p>Note: All references in the International Building Code to the International Electrical Code shall be considered to be references to NFPA 70.</p> <p>All references in the International Building Code to the International Fuel Gas Code shall be considered to be references to NFPA 54 and NFPA 58.</p> <p>All references in the International Building Code to the International Fire Code and Chapter 9 shall be considered to be references to Unified Facilities Criteria (UFC) 3-600-01.</p>
IMC	<p>International Mechanical Code –</p> <p>Note: For all references to “HEATING AND COOLING LOAD CALCULATIONS”, follow ASHRAE 90.1</p> <p>Note: For all references to “VENTILATION”, follow ASHRAE 62.1</p>
IRC	International Residential Code
IPC	International Plumbing Code
IEC	Energy Conservation Code (IEC) –Applicable only to the extent specifically referenced herein. Refer to Paragraph 5, ENERGY CONSERVATION requirements.
IGC	International Gas Code - not applicable. Follow NFPA 54, National Fuel Gas Code and NFPA 58, Liquefied Petroleum Gas Code.
<b>International Organization for Standardization (ISO)</b>	
ISO 6781:1983	Qualitative detection of thermal irregularities in building envelopes –

	infrared method
<b>LonMark International (LonMark)</b>	
LonMark Interoperability Guidelines	(available at <a href="http://www.lonmark.org">www.lonmark.org</a> ), including: Application Layer Guidelines, Layer 1-6 Guidelines, and External Interface File (XIF) Reference Guide
LonMark Resource Files	(available at <a href="http://www.lonmark.org">www.lonmark.org</a> ), including Standard Network Variable Type (SNVT) definitions
<b>Metal Building Manufacturers Association (MBMA)</b>	
	Metal Building Systems Manual
<b>Midwest Insulation Contractors Association (MICA)</b>	
	National Commercial and Industrial Insulation Standards Manual
<b>National Association of Corrosion Engineers International (NACE)</b>	
NACE RP0169	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE RP0185	Extruded, Polyolefin Resin Coating Systems with Adhesives for Underground or Submerged Pipe
NACE RP0285	Corrosion Control of Underground Storage Tank Systems by Cathodic Protection
NACE RP0286	Electrical Isolation of Cathodically Protected Pipelines
<b>National Electrical Manufacturers Association (NEMA)</b>	
<b>National Environmental Balancing Bureau (NEBB)</b>	
	Procedural Standards Procedural Standards for Testing Adjusting Balancing of Environmental Systems
<b>National Fire Protection Association (NFPA)</b>	
NFPA 10	Standard for Portable Fire Extinguishers
NFPA 13	Installation of Sprinkler Systems
NFPA 13R	Residential Occupancies up to and Including Four Stories in Height Sprinkler Systems

NFPA 14	Standard for the Installation of Standpipes and Hose Systems
NFPA 20	Installation of Centrifugal Fire Pumps
NFPA 24 NFPA 25	Standard for the Installation of Private Fire Service Mains and Their Appurtenances [underground fire protection system design]  Inspection, Testing And Maintenance Of Water-Based Fire Protection Systems
NFPA 30	Flammable and Combustible Liquids Code
NFPA 30A	Motor Fuel Dispensing Facilities and Repair Garages
NFPA 31	Installation of Oil Burning Equipment
NFPA 54	National Fuel Gas Code
NFPA 58	Liquefied Petroleum Gas Code
NFPA 70	National Electrical Code
NFPA 72	National Fire Alarm Code
NFPA 76	Fire Protection of Telecommunications Facilities
NFPA 80	Standard for Fire Doors and Fire Windows
NFPA 90a	Installation of Air Conditioning and Ventilating Systems
NFPA 96	Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
NFPA 101	Life Safety Code
NFPA 780	Standard for the Installation of Lightning Protection Systems
<b>National Roofing Contractor's Association (NRCA)</b>	
	Roofing and Waterproofing Manual
<b>National Sanitation Foundation, International</b>	
NSF/ANSI Std. 2, 3, 4, 5, 6, 7, 8, 12, 13, 18, 20, 21, 25, 29, 35, 36, 37, 51, 52, 59,	Food Equipment Standards



169	
ANSI/UL Std. 73, 197, 471, 621, 763	Food Equipment Standards
CSA Std. C22.2 No. 109, 120, 195	Food Equipment Standards
<b>Occupational Safety and Health Administration (OSHA)</b>	
Title 29, Part 1926	OSHA Construction Industry Standards, Title 29, Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction
<b>Plumbing and Drainage Institute (PDI)</b>	
PDI G 101	Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data
PDI WH201	Water Hammer Arrestors
<b>Precast Concrete Institute</b>	
PCI Design Handbook	Precast and Prestressed Concrete
<b>Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)</b>	
SMACNA HVAC Duct Construction Standards	HVAC Duct Construction Standards - Metal and Flexible
SMACNA Architectural Manual	Architectural Sheet Metal Manual
SMACNA HVAC TAB	HVAC Systems - Testing, Adjusting and Balancing
<b>State/Local Regulations</b>	
	State Department of Transportation Standard Specifications for Highway and Bridge Construction
	Sedimentation and Erosion Control Design Requirements
	Environmental Control Requirements
	Storm Water Management Requirements
<b>Steel Door Institute (SDI)</b>	

ANSI A250.8/SDI 100	Standard Steel Doors and Frames
<b>Steel Deck Institute</b>	
	SDI Diaphragm Design Manual
<b>Steel Joist Institute</b>	
	Catalog of Standard Specifications and Load Tables for Steel Joists and Joist Girders
<b>Underwriters Laboratories (UL)</b>	
UL 96A	Installation Requirements for Lightning Protection Systems
UL 300	Standard for Safety for Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas
<b>UNITED STATES ACCESS BOARD: U.S. ARCHITECTURAL AND TRANSPORTATION BARRIERS COMPLIANCE BOARD</b>	
ADA and ABA Accessibility Guidelines for Buildings and Facilities	<p>ABA Accessibility Standard for DoD Facilities</p> <p>Derived from the ADA and ABA Accessibility Guidelines: Specifically includes: ABA Chapters 1 and 2 and Chapters 3 through 10.</p> <p>Use this reference in lieu of IBC Chapter 11.</p> <p>Excluded are:</p> <p>(a) Facilities, or portions of facilities, on a military installation that are designed and constructed for use exclusively by able-bodied military personnel (See Paragraph 3 for any reference to this exclusion).</p> <p>(b) Reserve and National Guard facilities, or portions of such facilities, owned by or under the control of the Department of Defense, that are designed and constructed for use exclusively by able-bodied military personnel. (See paragraph 3 for any reference to this exclusion).</p>
<b>U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES</b>	
	FDA National Food Code
<b>U.S. GREEN BUILDING COUNCIL (USGBC)</b>	
LEED-NC	Green Building Rating System for New Construction & Major Renovations
	Application Guide for Multiple Buildings and On-Campus Building Projects

## 4.2. MILITARY CRITERIA

The project shall conform to the following criteria. Certain design impacts and features due to these criteria are noted for the benefit of the offeror. However, all requirements of the referenced criteria will be applicable, whether noted or not, unless otherwise specified herein.

4.2.1. Energy Policy Act of 2005 (Public Law 109-58) (applies only to the extent specifically implemented in the contract, which may or may not directly cite or reference EPACT)

4.2.2. Executive Order 12770: Metric Usage In Federal Government

(a) Metric design and construction is required except when it increases construction cost. Offeror to determine most cost efficient system of measurement to be used for the project.

4.2.3. TB MED 530: Occupational and Environmental Health Food Sanitation

4.2.4. Unified Facilities Criteria (UFC) 3-410-01FA: Heating, Ventilating, and Air Conditioning - applicable only to the extent specified in paragraph 5, herein.

4.2.5. Deleted.

4.2.6. UFC 3-600-01 Design: Fire Protection Engineering for Facilities. Use the latest edition of the IBC in coordination with this UFC. Use Chapters 3, 6, 7, 33 and UFC 3-600-01. If any conflict occurs between these Chapters and UFC 3-600-01, the requirements of UFC 3-600-01 take precedence. Use UFC 3-600-01 in lieu of IBC Chapters 4, 8,9,10.

4.2.7. UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings

4.2.8. UFC 4-023-03 Design of Buildings to Resist Progressive Collapse (Use most recent version, regardless of references thereto in other publications)

(a) Note the option to use tie force method or alternate path design for Occupancy Category II.

4.2.9. UFC 4-021-01 Design and O&M: Mass Notification Systems

4.2.10. Technical Criteria for Installation Information Infrastructure Architecture (I3A)

(a) Email: [DetrickISECI3Aguide@conus.army.mil](mailto:DetrickISECI3Aguide@conus.army.mil)

4.2.11. U.S. Army Information Systems Engineering Command (USAISEC) TG for the Integration of SECRET Internet Protocol (IP) Router Network (SIPRNET). See Paragraph 3 for applicability to specific facility type. May not apply to every facility. This is mandatory criteria for those facilities with SIPRNET.

## 5.0 GENERAL TECHNICAL REQUIREMENTS

This paragraph contains general technical requirements. See also Paragraph 3 for facility-specific technical requirements. Residential or similar grade finishes and materials are not acceptable for inclusion in these buildings, unless otherwise specifically allowed.

### 5.1. SITE PLANNING AND DESIGN

5.1.1. STANDARDS AND CODES: The site planning and design shall conform to APPLICABLE CRITERIA and to paragraph 6, PROJECT SPECIFIC REQUIREMENTS.

5.1.2. SITE PLANNING OBJECTIVES: Group buildings in configurations that create a sense of community and promote pedestrian use. See paragraph 3 for additional site planning requirements relating to building functions.

5.1.2.1. Provide enclosures and or visual screening devices for Outdoor Utility such as dumpsters, emergency generators, transformers, heating, ventilation, and air conditioning units from streetscape and courtyard views to limit visual impact. Enclosures shall be compatible with the building they serve and accessible by vehicle. The location of dumpsters can have a significant visual impact and should be addressed as part of an overall building design and incorporated in site planning.

5.1.2.2. Where included in the project, dumpster pads shall be concrete (minimum of 8 inches thick on 4 inch base course, unless site conditions dictate more conservative requirements) and directly accessible by way of a paved service drive or parking lot with adequate overhead clearance for collection vehicles. Provide space at dumpster areas for recycling receptacles. Coordinate with Installation on recycling receptacle types, sizes and access requirements and provide space at dumpster areas to accommodate them.

5.1.2.3. Vehicular Circulation. Apply design vehicle templates provided by the American Association of State Highway and Transportation Officials (AASHTO) to the site design. The passenger car class includes passenger cars and light trucks, such as vans and pick-ups. The passenger car template is equivalent to the non-organizational – privately owned vehicle (POV). The truck class template includes single-unit trucks, recreation vehicles, buses, truck tractor-semi-trailer combinations, and trucks or truck tractors with semi-trailers in combination with full trailers. Provide vehicle clearances required to meet traffic safety for emergency vehicles, service vehicles, and moving vans. Provide required traffic control signage Site entrances and site drive aisles shall maximize spacing between drives, incorporate right-angle turns, and limit points of conflict between traffic. Design Services Drives to restrict access to unauthorized vehicles by removable bollards, gates, or other barriers to meet Anti-Terrorism/Force Protection (ATFP) requirements. Orient service drives to building entrances other than the primary pedestrian entry at the front of the building.

5.1.2.4. Provide Emergency Vehicle Access around the facility and shall be in accordance with AT/FP requirements. Maintain a 33-foot clear zone buffer for emergency vehicles, designed to prevent other vehicles from entering the AT/FP standoff to the building.

5.1.2.5. Clear and grub all trees and vegetation necessary for construction; but, save as many trees as possible. Protect trees to be saved during the construction process from equipment.

5.1.2.6. Stormwater Management. Employ design and construction strategies (Best Management Practices) that reduce stormwater runoff, reduce discharges of polluted water offsite and maintain or restore predevelopment hydrology with respect to temperature, rate, volume and duration of flow to the maximum extent practicable. See paragraph 6, PROJECT SPECIFIC requirements for additional information.

5.1.3. EXTERIOR SIGNAGE: Provide exterior signage in accordance with Appendix H, Exterior Signage. Provide exterior NO SMOKING signage that conveys building and grounds smoking policy.

5.1.4. EXISTING UTILITIES: Base utilities maps and capacities for this site are included as part of this RFP. See paragraph 6 for more detailed information.

### 5.2. SITE ENGINEERING

5.2.1. STANDARDS AND CODES: The site engineering shall conform to APPLICABLE CRITERIA.

5.2.2. SOILS:

5.2.2.1. A report has been prepared to characterize the subsurface conditions at the project site and is **appended to these specifications**. The report provides a general overview of the soil and geologic conditions with detailed descriptions at discrete boring locations. The Contractor's team shall include a licensed geotechnical engineer to interpret the report and develop earthwork and foundation recommendations and design parameters in which to base the contractor's design. If any additional subsurface investigation or laboratory analysis is required to better characterize the site or develop the final design, the Contractor shall perform it under the direction of a licensed geotechnical engineer. There will be no separate payment for the cost of additional tests. If differences between the Contractor's additional subsurface investigation and the government provided soils report or the reasonably expected conditions require material revisions in the design, an equitable adjustment may be made, in accordance with the provisions of the Differing Site Conditions clause. The basis for the adjustment would be the design and construction appropriate for the conditions described in the Government furnished report or the reasonably expected conditions, in comparison with any changes required by material differences in the actual conditions encountered, in accordance with the terms of contract clause Differing Site Conditions.

5.2.2.2. The contractor's licensed geotechnical engineer shall prepare a final geotechnical evaluation report, to be submitted along with the first foundation design submittal, as described in Section 01 33 16, *Design After Award*.

5.2.3. VEHICLE PAVEMENTS: (as applicable to the project)

5.2.3.1. Design procedures and materials shall conform to one of the following: 1) the USACE Pavement Transportation Computer Assisted Structural Engineering (PCASE) program, 2) American Association of State Highway and Transportation Officials (AASHTO) or, 3) the applicable state Department of Transportation standards in which the project is located. See paragraph 5.2.2.2 and Section 01 33 16 for required information for the Contractor's geotechnical evaluation report. The minimum flexible pavement section shall consist of 2 inches of asphalt and 6 inches of base or as required by the pavement design, whichever is greater, unless specifically identified by the Government to be a gravel road. Design roads and parking areas for a life expectancy of 25 years with normal maintenance. Parking area for tactical vehicles (as applicable to the project) shall be Portland Cement Concrete (PCC) rigid pavement design. For concrete pavements, submit joint layout plan for review and concurrence. Design pavements for military tracked vehicles (as applicable to the project) IAW USACE PCASE. Traffic estimates for each roadway area will be as shown on the drawings or listed in Section 01 10 00 Paragraph 6.4.4. Pavement markings and traffic signage shall comply with the Installation requirements and with the Manual on Uniform Traffic Control Devices.

5.2.3.2. Parking Requirements.

- (a) All handicap POV parking lots (where applicable in the facility specific requirements) shall meet the ADA and ABA Accessibility Guidelines for accessible parking spaces.
- (b) Design POV parking spaces for the type of vehicles anticipated, but shall be a minimum of 9 ft by 18 ft for POVs, except for two wheel vehicles.

5.2.3.3. Sidewalks. Design the network of walks throughout the complex (where applicable) to facilitate pedestrian traffic among facilities, and minimize the need to use vehicles. Incorporate sidewalks to enhance the appearance of the site development, while creating a sense of entry at the primary patron entrances to the buildings. Minimum sidewalk requirements are in Paragraph 3, where applicable.

5.2.4. CATHODIC PROTECTION: Provide cathodic protection systems for all underground metallic systems and metallic fittings/portions of non-metallic, underground systems, both inside and outside the building 5 foot line that are subject to corrosion. Coordinate final solutions with the installation to insure an approach that is consistent with installation cathodic protection programs.

5.2.5. UTILITIES: See paragraph 6.4.6 for specific information on ownership of utilities and utility requirements. Meter all utilities (gas, water, and electric, as applicable) to each facility. For Government owned utilities, install meters that are wireless data transmission capable as well as have a continuous manual reading option. All meters will be capable of at least hourly data logging and transmission and provide consumption data for gas, water, and electricity. Gas and electric meters will also provide demand readings based on consumption over a maximum of

any 15 minute period. Configure all meters to transmit at least daily even if no receiver for the data is currently available at the time of project acceptance. For privatized utilities, coordinate with the privatization utility(ies) for the proper meter base and meter installation.

5.2.6. PERMITS: The CONTRACTOR shall be responsible for obtaining all permits (local, state and federal) required for design and construction of all site features and utilities.

5.2.7. IRRIGATION. Landscape irrigation systems, if provided, shall comply with the following:

5.2.7.1. Irrigation Potable Water Use Reduction. Reduce irrigation potable water use by 100 percent using LEED credit WE1.1 baseline (no potable water used for irrigation), except where precluded by other project requirements.

5.2.8. EPA WaterSense Products and Contractors. Except where precluded by other project requirements, use EPA WaterSense labeled products and irrigation contractors that are certified through a WaterSense labeled program where available.

### 5.3. ARCHITECTURE AND INTERIOR DESIGN:

This element will be evaluated per APPLICABLE CRITERIA under the quality focus.

5.3.1. STANDARDS AND CODES: The architecture and interior design shall conform to APPLICABLE CRITERIA.

5.3.2. GENERAL: Overall architectural goal is to provide a functional, quality, visually appealing facility that is a source of pride for the installation and delivered within the available budget and schedule.

5.3.3. COMPUTATION OF AREAS: See APPENDIX Q for how to compute gross and net areas of the facility(ies).

5.3.4. BUILDING EXTERIOR: Design buildings to enhance or compliment the visual environment of the Installation. Where appropriate, reflect a human scale to the facility. Building entrance should be architecturally defined and easily seen. When practical, exterior materials, roof forms, and detailing shall be compatible with the surrounding development and adjacent buildings on the Installation and follow locally established architectural themes. Use durable materials that are easy to maintain. Exterior colors shall conform to the Installation requirements. See paragraph 6.

5.3.4.1. Building Numbers: Each building shall have exterior signage permanently attached on two faces of the building indicating the assigned building number or address. Building number signage details and locations shall conform to Appendix H, Exterior Signage.

### 5.3.5. BUILDING INTERIOR

5.3.5.1. Space Configuration: Arrange spaces in an efficient and functional manner in accordance with area adjacency matrices.

5.3.5.2. Surfaces: Appearance retention is the top priority for building and furniture related finishes. Provide low maintenance, easily cleaned room finishes that are commercially standard for the facility occupancy specified, unless noted otherwise.

5.3.5.3. Color: The color, texture and pattern selections for the finishes of the building shall provide an aesthetically pleasing, comfortable, easily maintainable and functional environment for the occupants. Coordination of the building colors and finishes is necessary for a cohesive design. Color selections shall be appropriate for the building type. The use of color, texture and pattern shall be used to path or way find through the building. Trendy colors that will become dated shall be limited to non-permanent finishes such as carpet and paint. Finishes should be selected with regards to aesthetics, maintenance, durability, life safety and image. Limit the number of similar colors for each material. Color of Ceramic and porcelain tile grout shall be medium range color to help hide soiling. Plastic laminate and solid surface materials shall have patterns that are mottled, flecked or speckled. Finish colors of fire extinguisher cabinets, receptacle bodies and plates, fire alarms / warning lights, emergency lighting, and other miscellaneous items shall be coordinated with the building interior. Color of equipment items on ceilings (speakers, smoke detectors, grills, etc.) shall match the ceiling color.

5.3.5.4. Circulation: Circulation schemes must support easy way finding within the building.

5.3.5.5. Signage: Provide interior signage for overall way finding and life safety requirements. A comprehensive interior plan shall be from one manufacturer. Include the following sign types: (1) Lobby Directory, (2) Directional Signs; (3) Room Identification Signs; (4) Building Service Signs; (5) Regulatory Signs; (6) Official and Unofficial Signs (7) Visual Communication Boards (8) NO SMOKING signage that conveys building smoking policy. Use of emblems or logos may also be incorporated into the signage plan.

5.3.5.6. Window Treatment: Interior window treatments with adjustable control shall be provided in all exterior window locations for control of day light coming in windows or privacy at night. Uniformity of treatment color and material shall be maintained to the maximum extent possible within a building.

#### 5.3.6. COMPREHENSIVE INTERIOR DESIGN

5.3.6.1. Comprehensive Interior Design includes the integration of a Structural Interior Design (SID) and a Furniture, Fixtures and Equipment (FF&E) design and package. SID requires the design, selection and coordination of interior finish materials that are integral to or attached to the building structure. Completion of a SID involves the selection and specification of applied finishes for the building's interior features including, but not limited to, walls, floors, ceilings, trims, doors, windows, window treatments, built-in furnishings and installed equipment, lighting, and signage. The SID package includes finish schedules, finish samples and any supporting interior elevations, details or plans necessary to communicate the building finish design and build out. The SID also provides basic space planning for the anticipated FF&E requirements in conjunction with the functional layout of the building and design issues such as life safety, privacy, acoustics, lighting, ventilation, and accessibility. See Section 01 33 16 for SID design procedures.

The FF&E design and package includes the design, selection, color coordination and of the required furnishing items necessary to meet the functional, operational, sustainability, and aesthetic needs of the facility coordinated with the interior finish materials in the SID. The FF&E package includes the specification, procurement documentation, placement plans, ordering and finish information on all freestanding furnishings and accessories, and a cost estimate. Coordinate the selection of furniture style, function and configuration with the defined requirements. Examples of FF&E items include, but are not limited to workstations, seating, files, tables, beds, wardrobes, draperies and accessories as well as marker boards, tack boards, and presentation screens. Criteria for furniture selection include function and ergonomics, maintenance, durability, sustainability, comfort and cost. See Section 01 33 16 for FFE design procedures.

#### 5.4. STRUCTURAL DESIGN

5.4.1. STANDARDS AND CODES: The structural design shall conform to APPLICABLE CRITERIA.

5.4.2. GENERAL: The structural system needs to be compatible with the intended functions and components that allows for future flexibility and reconfigurations of the interior space. Select an economical structural system based upon facility size, projected load requirements and local availability of materials and labor. Base the structural design on accurate, site specific geotechnical information and anticipated loads for the building types and geographical location. When modular units or other pre-fabricated construction is used or combined with stick-built construction, fully coordinate and integrate the overall structural design between the two different or interfacing construction types. If the state that the project is located in requires separate, specific licensing for structural engineers (for instance, such as in Florida, California and others), then the structural engineer designer of record must be registered in that state.

5.4.3. LOADS: See paragraph 3 for facility specific (if applicable) and paragraph 6 for site and project specific structural loading criteria. Unless otherwise specified in paragraph 6, use Exposure Category C for wind. If not specified, use Category C unless the Designer of Record can satisfactorily justify another Exposure Category in its design analysis based on the facility Master Plan. Submit such exceptions for approval as early as possible and prior to the Interim Design Submittal in Section "Design After Award"

5.4.4. TERMITE TREATMENT: (Except Alaska) Provide termite prevention treatment in accordance with Installation and local building code requirements, using licensed chemicals and licensed applicator firm.

#### 5.5. THERMAL PERFORMANCE

5.5.1. STANDARDS AND CODES: Building construction and thermal insulation for mechanical systems shall conform to APPLICABLE CRITERIA.

5.5.2. BUILDING ENVELOPE SEALING PERFORMANCE REQUIREMENT. Design and construct the building envelope for office buildings, office portions of mixed office and open space (e.g., company operations facilities), dining, barracks and instructional/training facilities with a continuous air barrier to control air leakage into, or out of, the conditioned space. Clearly identify all air barrier components of each envelope assembly on construction documents and detail the joints, interconnections and penetrations of the air barrier components. Clearly identify the boundary limits of the building air barriers, and of the zone or zones to be tested for building air tightness on the drawings.

5.5.2.1. Trace a continuous plane of air-tightness throughout the building envelope and make flexible and seal all moving joints.

5.5.2.2. The air barrier material(s) must have an air permeance not to exceed 0.004 cfm / sf at 0.3" wg (0.02 L/s.m2 @ 75 Pa) when tested in accordance with ASTM E 2178

5.5.2.3. Join and seal the air barrier material of each assembly in a flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of these assemblies and components.

5.5.2.4. Support the air barrier so as to withstand the maximum positive and negative air pressure to be placed on the building without displacement, or damage, and transfer the load to the structure.

5.5.2.5. Seal all penetrations of the air barrier. If any unavoidable penetrations of the air barrier by electrical boxes, plumbing fixture boxes, and other assemblies are not airtight, make them airtight by sealing the assembly and the interface between the assembly and the air barrier or by extending the air barrier over the assembly.

5.5.2.6. The air barrier must be durable to last the anticipated service life of the assembly.

5.5.2.7. Do not install lighting fixtures with ventilation holes through the air barrier

5.5.2.8. Provide a motorized damper in the closed position and connected to the fire alarm system to open on call and fail in the open position for any fixed open louvers such as at elevator shafts.

5.5.2.9. Damper and control to close all ventilation or make-up air intakes and exhausts, atrium smoke exhausts and intakes, etc when leakage can occur during inactive periods.

5.5.2.10. Compartmentalize garages under buildings by providing air-tight vestibules at building access points.

5.5.2.11. Compartmentalize spaces under negative pressure such as boiler rooms and provide make-up air for combustion.

5.5.2.12. Performance Criteria and Substantiation: Submit the qualifications and experience of the testing entity for approval. Demonstrate performance of the continuous air barrier for the opaque building envelope by the following tests:

(a) Test the completed building and demonstrate that the air leakage rate of the building envelope does not exceed 0.25cfm/ft2 at a pressure differential of 0.3" w.g.(75 Pa) in accordance with ASTM's E 779 (2003) or E-1827-96 (2002). Accomplish tests using either pressurization or depressurization or both. Divide the volume of air leakage in cfm @ 0.3" w.g. (L/s @ 75 Pa) by the area of the pressure boundary of the building, including roof or ceiling, walls and floor to produce the air leakage rate in cfm/ft2 @ 0.3" w.g. (L/s.m2 @ 75 Pa). Do not test the building until verifying that the continuous air barrier is in place and installed without failures in accordance with installation instructions so that repairs to the continuous air barrier, if needed to comply with the required air leakage rate, can be done in a timely manner.

(b) Test the completed building using Infrared Thermography testing. Use infrared cameras with a resolution of 0.1deg C or better. Perform testing on the building envelope in accordance with ISO 6781:1983 and ASTM C1060-90(1997). Determine air leakage pathways using ASTM E 1186-03 Standard Practices for Air Leakage Site



Detection in Building Envelopes and Air Barrier Systems, and perform corrective work as necessary to achieve the whole building air leakage rate specified in (a) above.

(c) Notify the Government at least three working days prior to the tests to provide the Government the opportunity to witness the tests. Provide the Government written test results confirming the results of all tests.

## 5.6. PLUMBING

5.6.1. STANDARDS AND CODES: The plumbing system shall conform to APPLICABLE CRITERIA.

5.6.2. PRECAUTIONS FOR EXPANSIVE SOILS: Where expansive soils are present, the design for underslab piping systems and underground piping serving chillers, cooling towers, etc, shall include features to control forces resulting from soil heave. Some possible solutions include, but are not necessarily limited to, features such as flexible expansion joints, slip joints, horizontal offsets with ball joints, or multiple bell and spigot gasketed fittings. For structurally supported slabs, piping should be suspended from the structure with adequate space provided below the pipe for the anticipated soil movement.

5.6.3. HOT WATER SYSTEMS: For Hot Water heating and supply, provide a minimum temp of 140 Deg F in the storage tank and a maximum of 110 Deg F at the fixture, unless specific appliances or equipment specifically require higher temperature water supply.

5.6.4. SIZING HOT WATER SYSTEMS: Unless otherwise specified or directed in paragraph 3, design in accordance with ASHRAE Handbook Series (appropriate Chapters), ASHRAE Standard 90.1, and the energy conservation requirements of the contract. Size and place equipment so that it is easily accessible and removable for repair or replacement.

5.6.5. JANITOR CLOSETS: In janitor spaces/room/closets, provide at minimum, a service sink with heavy duty shelf and wall hung mop and broom rack(s).

5.6.6. FLOOR DRAINS: As a minimum, provide floor drains in mechanical rooms and areas, janitor spaces/rooms/closets and any other area that requires drainage from fixtures or equipment, drain downs, condensate, as necessary.

5.6.7. URINALS: Urinals shall be vitreous china, wall-mounted, wall outlet, non-water using, with integral drain line connection, and with sealed replaceable cartridge or integral liquid seal trap. Either type shall use a biodegradable liquid to provide the seal and maintain a sanitary and odor-free environment. Install, test and maintain in accordance with manufacturer's recommendations. Slope the sanitary sewer branch line for non-water use urinals a minimum of 1/4 inch per foot. Do not use copper tube or pipe for drain lines that connect to the urinal. Manufacturer shall provide an operating manual and on-site training to installation operations personnel for the proper care and maintenance of the urinal. For complexes, non-water using urinals are not required for barracks type spaces.

5.6.8. BUILDING WATER USE REDUCTION. Reduce building potable water use in each building 30 percent using IPC fixture performance requirements baseline.

5.6.9. Do not use engineered vent or Sovent® type drainage systems.

5.6.10. Where the seasonal design temperature of the cold water entering a building is below the seasonal design dew point of the indoor ambient air, and where condensate drip will cause damage or create a hazard, insulate plumbing piping with a vapor barrier type of insulation to prevent condensation. Do not locate water or drainage piping over electrical wiring or equipment unless adequate protection against water (including condensation) damage is provided. Insulation alone is not adequate protection against condensation. Follow ASHRAE Fundamentals Chapter 23, Insulation for Mechanical Systems, IMC paragraph 1107 and International Energy Conservation Code for pipe insulation requirements.

## 5.7. ELECTRICAL AND TELECOMMUNICATIONS SYSTEMS

5.7.1. STANDARDS AND CODES: The electrical systems for all facilities shall conform to APPLICABLE CRITERIA.

5.7.2. MATERIALS AND EQUIPMENT: Materials, equipment and devices shall, as a minimum, meet the requirements of Underwriters Laboratories (UL) where UL standards are established for those items. Wiring for branch circuits shall be copper. Motors larger than one-half horsepower shall be three phase. All electrical systems shall be pre-wired and fully operational unless otherwise indicated. Wall mounted electrical devices (power receptacles, communication outlets and CATV outlets) shall have matching colors, mounting heights and faceplates.

5.7.3. POWER SERVICE: Primary service from the base electrical distribution system to the pad-mounted transformer and secondary service from the transformer to the building service electrical equipment room shall be underground. See paragraph 6 for additional site electrical requirements.

5.7.3.1. Spare Capacity: Provide 10% space for future circuit breakers in all panelboards serving residential areas of buildings and 15% spaces in all other panelboards.

5.7.4. TELECOMMUNICATION SERVICE: The project's facilities must connect to the Installation telecommunications (voice and data) system through the outside plant (OSP) telecommunications underground infrastructure cabling system per the I3A Criteria. Connect to the OSP cabling system from each facility main cross connect located in the telecommunications room.

5.7.5. LIGHTING: Comply with the recommendations of the Illumination Engineering Society of North America (IESNA), the National Energy Policy Act and Energy Star requirements for lighting products..

5.7.5.1. Interior Lighting:

(a) Reflective Surfaces: Coordinate interior architectural space surfaces and colors with the lighting systems to provide the most energy-efficient workable combinations.

(b) High Efficiency Fluorescent Lighting: Utilize NEMA premium electronic ballasts and energy efficient fluorescent lamps with a Correlated Color Temperature (CCT) of 4100K. Linear fluorescent and compact fluorescent fixtures shall have a Color Rendering Index of (CRI) of 87 or higher. Fluorescent lamps shall be the low mercury type qualifying as non-hazardous waste upon disposal. Do not use surface mounted fixtures on acoustical tile ceilings. Provide an un-switched fixture with emergency ballast shall be provided at each entrance to the building.

(c) Solid State Lighting: Fixtures shall provide lighting with a minimum Correlated Color Temperature (CCT) of 4100K and shall have a Color Rendering Index of (CRI) of 75 or higher. Verify performance of the light producing solid state components by a test report in compliance with the requirements of IESNA LM 80. Verify performance of the solid state light fixtures by a test report in compliance with the requirements of IESNA LM 79. Provide lab results by a NVLAP certified laboratory. The light producing solid state components and drivers shall have a life expectancy of 50,000 operating hours while maintaining at least 70% of original illumination level. Provide a complete five year warranty for fixtures.

(d) Metal Halide Lighting (where applicable): Metal Halide lamp fixtures in the range of 150-500 Watts shall be pulse start type and have a minimum efficiency rating of 88%.

(e) Lighting Controls: ANSI/ASHRAE/IESNA 90.1 has specific lighting controls requirements. Provide a high level of lighting system control by individual occupants or by specific groups in multi-occupant spaces (classrooms, conference rooms) to promote the productivity, comfort and well being of the building occupants. In office spaces, the preferred lighting should be a 30 FC ambient lighting level with occupancy sensor controlled task lighting in the work spaces to provide a composite lighting level of 50 FC on the working surfaces. Consider incorporating daylighting techniques for the benefit of reducing lighting energy requirements while improving the quality of the indoor spaces. If daylight strategies are used, additional coordination is required with the architect and mechanical engineer. Additionally, incorporate electric lighting controls to take advantage of the potential energy savings.

(f) Exterior Lighting: See paragraph 6.9 for site specific information, if any, on exterior lighting systems. Minimize light pollution and light trespass by not over lighting and use cutoff type exterior luminaries.

5.7.6. TELECOMMUNICATION SYSTEM: All building telecommunications cabling systems (BCS) and OSP telecommunications cabling system shall conform to APPLICABLE CRITERIA to include I3A Technical Criteria. An acceptable BCS encompasses, but is not limited to, copper and fiber optic (FO) entrance cable, termination equipment, copper and fiber backbone cable, copper and fiber horizontal distribution cable, workstation outlets, racks, cable management, patch panels, cable tray, cable ladder, conduits, grounding, and labeling.. Items included

under OSP infrastructure encompass, but are not limited to, manhole and duct infrastructure, copper cable, fiber optic cable, cross connects, terminations, cable vaults, and copper and FO entrance cable.

5.7.6.1. Design, install, label and test all telecommunications systems in accordance with the I3A Criteria and ANSI/TIA/EIA 568, 569, and 606 standards. A Building Industry Consulting Services International (BICSI) Registered Communications Distribution Designer (RCDD) with at least 2 yrs related experience shall develop and stamp telecommunications design, and prepare the test plan. See paragraph 5.8.2.5 for design of environmental systems for Telecommunications Rooms.

5.7.6.2. The installers assigned to the installation of the telecommunications system or any of its components shall be regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. Key personnel; i.e., supervisors and lead installers assigned to the installation of this system or any of its components shall be BICSI Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel. In lieu of BICSI certification, supervisors and installers shall have a minimum of 5 years experience in the installation of the specified copper and fiber optic cable and components. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.

5.7.6.3. Perform a comprehensive end to end test of all circuits to include all copper and fiber optic cables upon completion of the BCS and prior to acceptance of the facility. The BCS circuits include but are not limited to all copper and fiber optic(FO) entrance cables, termination equipment, copper and fiber backbone cable, copper and fiber horizontal distribution cable, and workstation outlets. Test in accordance with ANSI/EIA/TIA 568 standards. Use test instrumentation that meets or exceeds the standard. Submit the official test report to include test procedures, parameters tested, values, discrepancies and corrective actions in electronic format. Test and accomplish all necessary corrective actions to ensure that the government receives a fully operational, standards based, code compliant telecommunications system.

5.7.7. LIGHTNING PROTECTION SYSTEM: Provide a lightning protection system where recommended by the Lightning Risk Assessment of NFPA 780, Annex L.

## 5.8. HEATING, VENTILATING, AND AIR CONDITIONING

5.8.1. STANDARDS AND CODES: The HVAC system shall conform to APPLICABLE CRITERIA.

### 5.8.2. DESIGN CONDITIONS.

5.8.2.1. Outdoor and indoor design conditions shall be in accordance with UFC 3-410-01FA. Outdoor air and exhaust ventilation requirements for indoor air quality shall be in accordance with ASHRAE 62.1. All Buildings with minimum LEED Silver requirement (or better) will earn LEED Credit EQ 7.1, Thermal Comfort-Design.

5.8.2.2. Design systems in geographical areas that meet the definition for high humidity in UFC 3-410-01FA in accordance with the special criteria for humid areas therein.

5.8.2.3. Cooling equipment may be oversized by up to 15 percent to account for recovery from night setback. Heating equipment may be oversized by up to 30 percent to account for recovery from night setback. Design single zone systems and multi-zone systems to maintain an indoor design condition of 50% relative humidity for cooling only. For heating only where the indoor relative humidity is expected to fall below 20% for extended periods, add humidification to increase the indoor relative humidity to 30%. Provide ventilation air from a separate dedicated air handling unit (DOAU) for facilities using multiple single zone fan-coil type HVAC systems. Do not condition outside air through fan coil units. Avoid the use of direct expansion cooling coils in air handling units with constant running fans that handle outside air.

5.8.2.4. Locate all equipment so that service, adjustment and replacement of controls or internal components are readily accessible for easy maintenance.

5.8.2.5. Environmental Requirements for Telecommunications Rooms,(including SIPRNET ROOMS, where applicable for specific facility type). Comply with ANSI/EIA/TIA 569 and the I3A.

5.8.2.6. Fire dampers: dynamic type with a dynamic rating suitable for the maximum air velocity and pressure differential to which the damper is subjected. Test each fire damper with the air handling and distribution system running.

5.8.3. BUILDING AUTOMATION SYSTEM. Provide a Building Automation System consisting of a building control network , and integrate the building control network into the UMCS as specified.

The building control network shall be a single complete non-proprietary Direct Digital Control (DDC) system for control of the heating, ventilating and air conditioning (HVAC) systems as specified herein. The building control network shall be an Open implementation of LONWORKS® technology using ANSI/EIA 709.1B as the only communications protocol and use only LonMark Standard Network Variable Types (SNVTs), as defined in the LonMark® Resource Files, for communication between DDC Hardware devices to allow multi-vendor interoperability.

5.8.3.1. The building automation system shall be open in that it is designed and installed such that the Government or its agents are able to perform repair, replacement, upgrades, and expansions of the system without further dependence on the original Contractor. This includes, but is not limited to the following:

- (a) Install hardware such that individual control equipment can be replaced by similar control equipment from other equipment manufacturers with no loss of system functionality.
- (b) Necessary documentation (including rights to documentation and data), configuration information, configuration tools, programs, drivers, and other software shall be licensed to and otherwise remain with the Government such that the Government or its agents are able to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the Contractor.

5.8.3.2. All DDC Hardware shall:

- (a) Be connected to a TP/FT-10 ANSI/EIA 709.3 control network.
- (b) Communicate over the control network via ANSI/EIA 709.1B exclusively.
- (c) Communicate with other DDC hardware using only SNVTs
- (d) Conform to the LonMark® Interoperability Guidelines.
- (e) Be locally powered; link power (over the control network) is not acceptable.
- (f) Be fully configurable via standard or user-defined configuration parameter types (SCPT or UCPT), standard network variable type (SNVT) network configuration inputs (*nci*), or hardware settings on the controller itself to support the application. All settings and parameters used by the application shall be configurable via standard or user-defined configuration parameter types (SCPT or UCPT), standard network variable type (SNVT) network configuration inputs (*nci*), or hardware settings on the controller itself
- (g) Provide input and output SNVTs required to support monitoring and control (including but not limited to scheduling, alarming, trending and overrides) of the application. Required SNVTs include but are not limited to: SNVT outputs for all hardware I/O, SNVT outputs for all setpoints and SNVT inputs for override of setpoints.
- (h) To the greatest extent practical, not rely on the control network to perform the application..

5.8.3.3. Controllers shall be Application Specific Controllers whenever an ASC suitable for the application exists. When an ASC suitable for the application does not exist use programmable controllers or multiple application specific controllers.

5.8.3.4. Application Specific Controllers shall be LonMark Certified whenever a LonMark Certified ASC suitable for the application exists. For example, VAV controllers must be LonMark certified.

5.8.3.5. Application Specific Controllers (ASCs) shall be configurable via an LNS plug-in whenever t an ASC with an LNS plug-in suitable for the application exists.

5.8.3.6. Each scheduled system shall accept a network variable of type SNVT\_occupancy and shall use this network variable to determine the occupancy mode. If the system has not received a value to this network variable for more than 60 minutes it shall default to a configured occupancy schedule.

5.8.3.7. Gateways may be used provided that each gateway communicates with and performs protocol translation for control hardware controlling one and only one package unit.

5.8.3.8. Not Used

5.8.3.9. Perform all necessary actions needed to fully integrate the building control system. These actions include but are not limited to:

- Configure M&C Software functionality including: graphical pages for System Graphic Displays including overrides, alarm handling, scheduling, trends for critical values needing long-term or permanent monitoring via trends, and demand limiting.
- Install IP routers or ANSI/CEA-852 routers as needed to connect the building control network to the UMCS IP network. Routers shall be capable of configuration via DHCP and use of an ANSI/CEA-852 configuration server but shall not rely on these services for configuration. All communication between the UMCS and building networks shall be via the ANSI/CEA-709.1B protocol over the IP network in accordance with ANSI/CEA-852.

5.8.3.10. Provide the following to the Government for review prior to acceptance of the system:

- The latest version of all software and user manuals required to program, configure and operate the system.
- Points Schedule drawing that shows every DDC Hardware device. The Points Schedule shall contain the following information as a minimum:
  - Device address and NodeID.
  - Input and Output SNVTs including SNVT Name, Type and Description.
  - Hardware I/O, including Type (AI, AO, BI, BO) and Description.
  - Alarm information including alarm limits and SNVT information.
  - Supervisory control information including SNVTs for trending and overrides.
  - Configuration parameters (for devices without LNS plug-ins) Example Points Schedules are available at <https://eko.usace.army.mil/fa/besc/>
- Riser diagram of the network showing all network cabling and hardware. Label hardware with ANSI.CEA-709.1 addresses, IP addresses, and network names.
- Control System Schematic diagram and Sequence of Operation for each HVAC system.
- Operation and Maintenance Instructions including procedures for system start-up, operation and shut-down, a routine maintenance checklist, and a qualified service organization list.
- LONWORKS® Network Services (LNS®) database for the completed system.
- Quality Control (QC) checklist (below) completed by the Contractor's Chief Quality Control (QC) Representative

**Table 5-1: QC Checklist**

Instructions: Initial each item, sign and date verifying that the requirements have been met.		
#	Description	Initials
1	All DDC Hardware is installed on a TP/FT-10 local control bus.	
2	Communication between DDC Hardware is only via EIA 709.1B using SNVTs. Other protocols and network variables other than SNVTs have not been used.	
3	All sequences are performed using DDC Hardware.	
4	LNS Database is up-to-date and accurately represents the final installed system	
5	All software has been licensed to the Government	
6	M&C software monitoring displays have been created for all building systems, including all override and display points indicated on Points Schedule drawings.	
7	Final As-built Drawings accurately represent the final installed system.	
8	O&M Instructions have been completed and submitted.	
9	Connections between the UMCS IP network and ANSI/CEA-709.1B building networks are through ANSI/CEA-852 Routers.	
By signing below I verify that all requirements of the contract, including but not limited to the above, been met.		
Signature: _____ Date: _____		

5.8.3.11. Perform a Performance Verification Test (PVT) under Government supervision prior to system acceptance. During the PVT demonstrate that the system performs as specified, including but not limited to demonstrating that the system is Open and correctly performs the Sequences of Operation.

5.8.3.12. Provide a 1 year unconditional warranty on the installed system and on all service call work. The warranty shall include labor and material necessary to restore the equipment involved in the initial service call to a fully operable condition.

5.8.3.13. Provide training at the project site on the installed building system. Upon completion of this training each student, using appropriate documentation, should be able to start the system, operate the system, recover the system after a failure, perform routine maintenance and describe the specific hardware, architecture and operation of the system.

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5.8.4. TESTING, ADJUSTING AND BALANCING. Test and balance air and hydronic systems, using a firm certified for testing and balancing by the Associated Air Balance Council (AABC), National Environmental Balancing Bureau (NEBB), or the Testing Adjusting, and Balancing Bureau (TABB). The prime contractor shall hire the TAB firm directly, not through a subcontractor. Perform TAB in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC MN-1, NEBB TABES, or SMACNA HVACTAB unless otherwise specified herein. All recommendations and suggested practices contained in the TAB Standard shall be considered mandatory. Use the provisions of the TAB Standard, including checklists, report forms, etc., as nearly as practicable to satisfy the Contract requirements. Use the TAB Standard for all aspects of TAB, including qualifications for the TAB Firm and Specialist and calibration of TAB instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB Standard, adhere to the manufacturer's recommendations. All quality assurance provisions of the TAB Standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the TAB Standard, the TAB Specialist shall develop TAB procedures. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the TAB Standard used (AABC, NEBB, or TABB), the requirements and recommendations contained in these procedures and requirements are mandatory.

5.8.5. COMMISSIONING: Commission all HVAC systems and equipment, including controls, and all systems requiring commissioning for LEED Enhanced commissioning, in accordance with ASHRAE Guideline 1.1, ASHRAE Guideline 0 and LEED. Do not use the sampling techniques discussed in ASHRAE Guideline 1.1 and in ASHRAE Guideline 0. Commission 100% of the HVAC controls and equipment. Hire the Commissioning Authority (CA), certified as a CA by AABC, NEBB, or TABB, as described in Guideline 1.1. The CA will be an independent subcontractor to the contractor and not an employee or subcontractor of any other subcontractor on this project. The CA will not have business connections with any other party on the project. The CA will not have any other role or responsibilities outside of commissioning activities. The CA will communicate and report directly to the Government in the execution of the commissioning activities. The Contracting Officer's Representative will act as the Owner's representative in performance of duties spelled out under OWNER in Annex F of ASHRAE Guideline 0. All buildings with Minimum LEED Silver (or better) requirement will earn LEED Credit EA3 Enhanced Commissioning.

## 5.9. ENERGY CONSERVATION

5.9.1. The building including the building envelope, HVAC systems, service water heating, power, and lighting systems shall meet the Mandatory Provisions and the Prescriptive Path requirements of ASHRAE 90.1. Substantiation requirements are defined in Section 01 33 16, Design After Award.

5.9.2. Design all building systems and elements to meet the minimum requirements of ANSI/ASHRAE/IESNA 90.1. Design the buildings, including the building envelope, HVAC systems, service water heating, power, and lighting systems to achieve an energy consumption that is at least 40% below the consumption of a baseline building meeting the minimum requirements of ANSI/ASHRAE/IESNA Standard 90.1. Energy calculation methodologies and substantiation requirements are defined in Section 01 33 16, Design After Award.

5.9.3. Purchase Energy Star products, except use FEMP designated products where FEMP is applicable to the type product. The term "Energy Star product" means a product that is rated for energy efficiency under an Energy Star program. The term "FEMP designated product" means a product that is designated under the Federal Energy

Management Program of the Department of Energy as being among the highest 25 percent of equivalent products for energy efficiency. When selecting integral sized electric motors, choose NEMA PREMIUM type motors that conform to NEMA MG 1, minimum Class F insulation system. Motors with efficiencies lower than the NEMA PREMIUM standard may only be used in unique applications that require a high constant torque speed ratio (e.g., inverter duty or vector duty type motors that conform to NEMA MG 1, Part 30 or Part 31).

5.9.4. Solar Hot Water Heating. Provide at least 30% of the domestic hot water requirements through solar heating methodologies, unless the results of a Life Cycle Cost Analysis (LCCA) developed utilizing the Building Life Cycle Cost Program (BLCC) which demonstrates that the solar hot water system is not life cycle cost effective in comparison with other hot water heating systems. The type of system will be established during the contract or task order competition and award phase, including submission of an LCCA for government evaluation to justify non-selection of solar hot water heating. The LCCA uses a study period of 25 years and the Appendix K utility cost information. The LCCA shall include life cycle cost comparisons to a baseline system to provide domestic hot water without solar components, analyzing at least three different methodologies for providing solar hot water to compare against the baseline system.

5.9.5. Process Water Conservation. When potable water is used to improve a building's energy efficiency, employ lifecycle cost effective water conservation measures, except where precluded by other project requirements.

5.9.6. Renewable Energy Features. The Government's goal is to implement on-site renewable energy generation for Government use when lifecycle cost effective. See Paragraph 6, PROJECT SPECIFIC REQUIREMENTS for renewable energy requirements for this project.

## 5.10. FIRE PROTECTION

5.10.1. STANDARDS AND CODES Provide the fire protection system conforming to APPLICABLE CRITERIA.

5.10.2. Inspect and test all fire suppression equipment and systems, fire pumps, fire alarm and detection systems and mass notification systems in accordance with the applicable NFPA standards. The fire protection engineer of record shall witness final tests. The fire protection engineer of record shall certify that the equipment and systems are fully operational and meet the contract requirements. Two weeks prior to each final test, the contractor shall notify, in writing, the installation fire department and the installation public work representative of the test and invite them to witness the test.

5.10.3. Fire Extinguisher Cabinets: Provide fire extinguisher cabinets and locations for hanging portable fire extinguishers in accordance with NFPA 10 Standard for Portable Fire Extinguishers.

5.10.4. Fire alarm and detection system: Required fire alarm and detection systems shall be the addressable type. Fire alarm initiating devices, such as smoke detectors, heat detectors and manual pull stations shall be addressable. When the system is in alarm condition, the system shall annunciate the type and location of each alarm initiating device. Sprinkler water flow alarms shall be zoned by building and by floor. Supervisory alarm initiating devices, such as valve supervisory switches, fire pump running alarm, low-air pressure on dry sprinkler system, etc. shall be zoned by type and by room location.

5.10.5. Fire Protection Engineer Qualifications: In accordance with UFC 3-600-01, FIRE PROTECTION ENGINEERING FOR FACILITIES, the fire protection engineer of record shall be a registered professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveys (NCEES), or a registered P.E. in a related engineering discipline with a minimum of 5 years experience, dedicated to fire protection engineering that can be verified with documentation.

## 5.11. SUSTAINABLE DESIGN

5.11.1. STANDARDS AND CODES: Sustainable design shall conform to APPLICABLE CRITERIA. See paragraph 6, PROJECT-SPECIFIC REQUIREMENTS for which version of LEED applies to this project. The LEED-NC Application Guide for Multiple Buildings and On-Campus Building Projects (AGMBC) applies to all projects. Averaging may be used for LEED compliance as permitted by the AGMBC but is restricted to only those buildings included in this project. Each building must individually comply with the requirements of paragraphs ENERGY CONSERVATION and BUILDING WATER USE REDUCTION.

5.11.2. LEED RATING, REGISTRATION, VALIDATION AND CERTIFICATION: See Paragraph PROJECT-SPECIFIC REQUIREMENTS for project minimum LEED rating/achievement level, for facilities that are exempt from the minimum LEED rating, for LEED registration and LEED certification requirements and for other project-specific information and requirements.

5.11.2.1. Innovation and Design Credits. LEED Innovation and Design (ID) credits are acceptable only if they are supported by formal written approval by GBCI (either published in USGBC Innovation and Design Credit Catalog or accompanied by a formal ruling from GBCI). LEED ID credits that require any Owner actions or commitments are acceptable only when Owner commitment is indicated in paragraph PROJECT-SPECIFIC REQUIREMENTS or Appendix LEED Project Credit Guidance

5.11.3. OPTIMIZE ENERGY PERFORMANCE. : Project must earn, as a minimum, the points associated with compliance with paragraph ENERGY CONSERVATION. LEED documentation differs from documentation requirements for paragraph ENERGY CONSERVATION and both must be provided. For LEED-NC v2.2 projects you may substitute ASHRAE 90.1 2007 Appendix G in its entirety for ASHRAE 90.1 2004 in accordance with USGBC Credit Interpretation Ruling dated 4/23/2008.

5.11.4. COMMISSIONING. See paragraph 5.8.5 COMMISSIONING for commissioning requirements. USACE templates for the required Basis of Design document and Commissioning Plan documents are available at <http://en.sas.usace.army.mil> (click on Engineering Criteria) and may be used at Contractor's option.

5.11.5. DAYLIGHTING. Except where precluded by other project requirements, do the following in at least 75 percent of all spaces occupied for critical visual tasks: achieve a 2 percent glazing factor (calculated in accordance with LEED credit EQ8.1) OR earn LEED Daylighting credit, provide appropriate glare control and provide either automatic dimming controls or occupant-accessible manual lighting controls.

5.11.6. LOW-EMITTING MATERIALS. Except where precluded by other project requirements, use materials with low pollutant emissions, including but not limited to composite wood products, adhesives, sealants, interior paints and finishes, carpet systems and furnishings,

5.11.7. CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT. Except where precluded by other project requirements, earn LEED credit EQ 3.1 Construction IAQ Management Plan, During Construction and credit EQ 3.2 Construction IAQ Management Plan, Before Occupancy.

5.11.8. RECYCLED CONTENT. In addition to complying with section RECYCLED/RECOVERED MATERIALS, earn LEED credit MR4.1, Recycled Content, 10 percent except where precluded by other project requirements.

5.11.9. BIOBASED AND ENVIRONMENTALLY PREFERABLE PRODUCTS. Except where precluded by other project requirements, use materials with biobased content, materials with rapidly renewable content, FSC certified wood products and products that have a lesser or reduced effect on human health and the environment over their lifecycle to the maximum extent practicable.

5.11.10. FEDERAL BIOBASED PRODUCTS PREFERRED PROCUREMENT PROGRAM (FB4P). The Farm Security and Rural Investment Act (FSRIA) of 2002 required the U.S. Department of Agriculture (USDA) to create procurement preferences for biobased products that are applicable to all federal procurement (to designate products for biobased content). For all designated products that are used in this project, meet USDA biobased content rules for them except use of a designated product with USDA biobased content is not required if the biobased product (a) is not available within a reasonable time, (b) fails to meet performance standard or (c) is available only at an unreasonable price. For biobased content product designations, see <http://www.biopreferred.gov/ProposedAndFinalItemDesignations.aspx>.

5.12. CONSTRUCTION AND DEMOLITION (C&D) WASTE MANAGEMENT: Achievement of 50% diversion, by weight, of all non-hazardous C&D waste debris is required. Reuse of excess soils, recycling of vegetation, alternative daily cover, and wood to energy are not considered diversion in this context, however the Contractor must track and report it. A waste management plan and waste diversion reports are required, as detailed in Section 01 57 20.00 10, ENVIRONMENTAL PROTECTION.

5.13. SECURITY (ANTI-TERRORISM STANDARDS): Unless otherwise specified in Project Specific Requirements, only the minimum protective measures as specified by the current Department of Defense Minimum



Antiterrorism Standards for Buildings, UFC 4-010-01, are required for this project. The element of those standards that has the most significant impact on project planning is providing protection against explosives effects. That protection can either be achieved using conventional construction (including specific window requirements) in conjunction with establishing relatively large standoff distances to parking, roadways, and installation perimeters or through building hardening, which will allow lesser standoff distances. Even with the latter, the minimum standoff distances cannot be encroached upon. These setbacks will establish the maximum buildable area. All standards in Appendix B of UFC 4-010-01 must be followed and as many of the recommendations in Appendix C that can reasonably be accommodated should be included. The facility requirements listed in these specifications assume that the minimum standoff distances can be met, permitting conventional construction. Lesser standoff distances (with specific minimums) are not desired, however can be provided, but will require structural hardening for the building. See Project Specific Requirements for project specific siting constraints. The following list highlights the major points but the detailed requirements as presented in Appendix B of UFC 4-010-01 must be followed.

- (a) Standoff distance from roads, parking and installation perimeter; and/or structural blast mitigation
- (b) Blast resistant windows and skylights, including glazing, frames, anchors, and supports
- (c) Progressive collapse resistance for all facilities 3 stories or higher
- (d) Mass notification system (shall also conform to UFC 4-021-01, Mass Notification Systems)
- (e) For facilities with mailrooms (see paragraph 3 for applicability) – mailrooms have separate HVAC systems and are sealed from rest of building

## **6.0 PROJECT SPECIFIC REQUIREMENTS FORT HOOD, TX**

### **6.1. GENERAL**

The requirements of this paragraph augment the requirements indicated in Paragraphs 3 through 5.

### **6.2. APPROVED DEVIATIONS**

The following are approved deviations from the requirements stated in Paragraphs 3 through 5 that only apply to this project.

NONE

### **6.3. SITE PLANNING AND DESIGN**

#### **6.3.1. General:**

6.3.1.1. Site Development Plan (SDP). The SDP provided by the government is included within the Appendices. Bring any discrepancies which are found in the furnished plans to the attention of the Contracting Officer's Representative.

6.3.1.2. Building Setback and Force Protection: Lay the site out based on the facility threat security level to protect against exterior attack by providing standoff distance between an aggressor or bomb, barriers, and to facilitate visual monitoring of the site. See the force protection requirements in UFC 4-010-01.

6.3.1.3. Building Spacing: Fire clearance separations shall be in accordance with UFC 3-600-01 and the International Building Code. Verify that fire clearances and access for equipment is acceptable to the installation's Fire Chief. Separation for buildings shall conform to force protection requirements per UFC 4-010-01.

6.3.1.4. Confine pad preparation operations to the work area defined by the SDP.

6.3.1.5. Walks: Locate walks paralleling buildings beyond the eave drip line and at least 5 feet from the foundation. Walks paralleling parking areas shall be at least 6 feet wide and shall abut the back of the curb.

6.3.1.6. Troop Formation Areas: Walkways for troops marching in formation shall be wide enough to accommodate personnel walking four abreast. The walkways shall be constructed of concrete and minimum 6 feet wide and 4" thick.

#### **6.3.1.7. Parking Areas:**

Perimeter concrete curbs and gutters shall be provided for all parking areas and access drives in developed areas. In remote or little used areas, concrete curbs and gutters will be used only when required to control drainage. Where flexible pavements are used, removable prefabricated reinforced concrete wheel stops, as approved, can be used. Where a walkway is required between parking spaces the Contractor shall provide either concrete curb and gutter or prefabricated reinforced concrete wheel stops. The walkway shall be a minimum 6 foot wide. Refer to drawings Appendix J. This contract only includes incidental "parking" work. Parking is generally being provided by a contract currently under construction. See the site drawings for this project for additional information.

#### **6.3.2. Site Structures and Amenities**

6.3.2.1. Dumpsters: Coordinate location of the dumpsters with the Installation. Provide concrete loading aprons for the first 15 feet in front of the dumpster pads to accommodate loading and to avoid rutting of the pavement in front of the dumpsters. Provide the following number of dumpsters:

Coordinate location of the dumpsters with the Installation and in accordance with UFC 4-010-01. Provide concrete loading aprons for the first 15 feet in front of the dumpster pads to accommodate loading and to

avoid rutting of the pavement in front of the dumpsters. Provide dumpster screening that is compatible with the building it serves and sized to accommodate both trash (front loading) and recycling (side loading) dumpsters. Provide the following number of dumpsters: one trash dumpster and one recycling dumpster for the Family Life Center. Incorporate planting to buffer the visual impact of screen walls. Walls should be a minimum of 6 feet in height. Containers should be 3 feet from the side of the screening structure to allow adequate pedestrian and truck access. When more than one container is located within a screened area, clearance between containers must be 2 feet.

### 6.3.3. Site Functional Requirements:

#### 6.3.3.1. Stormwater Management (SWM) Systems.

- (a) Comply with the requirements of general permit number

TXR150000. All Construction Storm Water regulations must be adhered to as set forth in the Texas Commission on Environmental Quality (TCEQ) Construction General Permit (CGP) TXR150000.

The Contractor shall install Low Impact Development (LID) stormwater management measures that meet the requirements of Section 438 of the Energy Independence and Security Act of 2007. The contractor's design shall maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the site with regard to the temperature, rate, volume, and duration of flow in accordance with Section 438 of the Energy Independence and Security Act of 2007. Design of the stormwater management facilities shall be in accordance with the Environmental Protection Agency's (EPA) Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act, dated December 2009.

- (b) Storm Drainage System Plans are shown within the SDP. Tie into these systems as appropriate for his areas of design responsibility. Design and construction of the storm drainage system shall be in accordance with Federal Aviation Administration Advisory Circular FAA AC 150-5320-5C, Surface Drainage Design; Federal Highway Administration Publication No. FHWA-NHI-01-021, Hydraulic Engineering Circular No. 22, Second Edition, URBAN DRAINAGE DESIGN MANUAL; and U.S. Weather Bureau Technical Paper No. 40, dated May 1961, Rainfall Frequency Atlas of the United States for Durations from 30 minutes to 24 hours, and return periods from 1 to 100 years. Base the design of drainage structures on a 10-year storm frequency. Incorporate the principles of Low Impact Development (LID), as detailed in UFC 3-210-10 DESIGN: LOW IMPACT DEVELOPMENT MANUAL. Construct manholes, surface inlets, and curb inlets of reinforced concrete or pre-cast reinforced concrete. Design structures in pavement to handle H-20 loading. Structures in turfed areas can be constructed for lighter weight loading. Design the storm drainage system to be as economical as possible, while taking into account the topography, drainage area, and outfall locations, as well as coordination with existing drainage systems, and existing and future underground utilities. Profiles are required for underground storm drainage systems and sections are required for culverts.

- (c) Underground Systems: Whenever possible, match pipe crowns in elevations. Profiles of pipes shall show all existing and new underground utilities and pertinent surface features. Design the minimum pipe gradient shall be designed to provide a minimum velocity (full flow) of 3.0 fps. Design the new outfall and receiving channel to withstand the shear stress acting on the channel from the runoff to prevent erosion. Size new underground storm drainage pipes by computation of backwater surface profiles. The minimum pipe size shall be 12 inches, unless the pipe is a part of the roof drain system, in which case the minimum size of laterals and collector pipes is 4 inches.

- (d) Street Drainage: Accomplish street drainage by the use of curb and gutter and curb inlets. Curb gaps can be considered in areas where roadside ditches are used. The center one-third of the street shall not convey runoff during the passing of the design storm. Do not use inverted crown sections for the streets without prior approval. Do not locate curb inlets in the radius of street intersections, at curb returns, or where pedestrian traffic is most likely to occur.

- (e) POV Parking and Hardstands: Do not concentrate the flow of storm runoff on asphalt pavement. Convey storm runoff within POV parking areas to perimeter curbs by sheetflow. However, if it is necessary to concentrate flow within a parking area, provide concrete paving at the swale flowline. Concentrated flow will not be permitted to

flow from POV parking or hardstand areas onto adjacent gravel areas or turfed slopes. Examine sheetflow from parking areas and hardstands onto adjacent gravel or turfed areas for possible erosive effects.

(f) Ditches and Swales: Use a minimum longitudinal ditch or swale gradient of 0.5% with an absolute minimum of 0.3% . Side slopes on ditches or swales shall be no steeper than 1 vertical on 2-1/2 horizontal. Pave steeper slopes. Use Turf Reinforcement Matting (TRM) in ditches that are subject to high velocity storm runoff. Use erosion control matting as necessary to control erosion on steeper slopes.

(g) Culverts: The recommended gradient of culverts shall be 0.5% with an absolute minimum of 0.3%. Provide concrete headwalls or end sections for all culverts. Design headwalls and end sections to reduce velocities to levels that are non-erosive for the soil types encountered.

6.3.3.2. Erosion and Sediment Control: Prepare and comply with Storm Water Pollution Prevention Plans (SWPPP) for the limits of the entire construction site. Include silt fences, mulch straw/hay bales around inlets, and sediment traps to control erosion during construction.

#### 6.3.3.3. Vehicular Circulation.

(a) Geometric Features: Geometric design of all roads, streets, access drives, and parking areas shall conform to the requirements presented in AASHTO, a Policy of Geometric Design of Highways and Streets. Verify with the local installation that access for fire equipment is adequate. Radii, to back of curb, for intersections are standardized as follows:

Primary and Secondary Intersection - 30 feet

Tertiary intersections - 20 feet

Access drives at end parking space - 5 feet

(b) Parking: Provide perimeter concrete curbs and gutters for all parking areas and access drives in developed areas. In remote or little used areas, use concrete curbs and gutters only when required to control drainage. Where flexible pavements are used, removable prefabricated reinforced concrete wheel stops, as approved, may be used.

(c) Service Drives: Widths of drives to unloading ramps or docks for usual types of trucks or tractor trailers are:

Trucks, Single-Unit - 12 feet

Semi-trailers - 16 feet

#### 6.4. SITE ENGINEERING

6.4.1. Existing Topographical Conditions: The government furnished survey Horizontal and Vertical control complies with EM 1110-1-8005, Table 2-1, Military Construction, Building or Structure Design.

The government furnished survey Horizontal and Vertical control complies with EM 1110-1-8005, Table 2-1, Military Construction, Building or Structure Design. Horizontal control is based on Texas State Plane Coordinate System, Central Zone, NAD-83. Vertical control is based on NGVD-29. The government furnished survey was performed using English units in survey feet and using the level names of AEC 3.0 CADD standards with the Southwestern Division, Fort Worth District file naming convention. (HYPERLINK "<https://cadbim.usace.army.mil/CAD>"<https://cadbim.usace.army.mil/CAD> and HYPERLINK

"<http://www.swf.usace.army.mil/pubdata/ed/mech/>"<http://www.swf.usace.army.mil/pubdata/ed/mech/>)

The Family Life Center site is currently being utilized as a staging area for the Chapel. It is anticipated that the site will be restored to the condition shown on this survey, however, it is the Contractor's responsibility to verify this topographic information.

6.4.2. Existing Geotechnical conditions: See Appendix A for a preliminary geotechnical report.

6.4.2.1. Existing Subsurface Conditions: A Government Preliminary Geotechnical Report has been prepared, and is appended to these specifications (Appendix A). The Government Geotechnical Report provides a general overview of the areal geologic conditions with detailed descriptions of the subsurface strata encountered during the

Government geotechnical field investigation. Based on the results of the field investigation, laboratory testing program, and engineering analyses, the Government Geotechnical Report further provides parameters and minimum foundation design requirements. However, as stated in the Government Geotechnical Report, the Contractor is responsible for drilling additional borings at the site, and performing additional laboratory testing (specified in the Government Geotechnical Report). The Contractor's additional geotechnical field investigations shall be ONLY for the purpose of supplementing the data regarding subsurface conditions provided by the Government geotechnical field investigation, as presented in the Government Geotechnical Report.

6.4.3. Fire Flow Tests See Appendix D for results of fire flow tests to use for basis of design for fire flow and domestic water supply requirements.

The Contractor shall verify that the fire flow requirements of the new facility(s) can be met by the hydrants indicated. See paragraph 6.13 for fire protection design requirements.

6.4.4. Pavement Engineering and Traffic Estimates:

6.4.4.1. Pavements: Geometric design of roads and streets shall follow the guidance provided in AASHTO - A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS and GUIDELINES FOR GEOMETRIC DESIGN OF VERY LOW-VOLUME LOCAL ROADS (ADT≤400). Design pavement structures in accordance with criteria contained in AASHTO - GUIDE FOR DESIGN OF PAVEMENT STRUCTURES. Vehicle types expected to occupy the pavements and their frequency of use are as follows:

personal vehicles, such as cars and small trucks, trash trucks, and fire/emergency medical vehicles. Base the design on an Equivalent Single Axle Load (ESAL) of 4726. Paved access is required to mechanical rooms/yards. New curb and gutter shall be concrete paved.

a. Provide pavement markings and striping in accordance with state DOT standards and the Manual of Uniform Traffic Control Devices (MUTCD). Provide channelization and pavement markings as required by the FHWA MUTCD and FHWA Standard Highway Signs.

6.4.4.2. Emergency Vehicle Access: Provide access drives to allow access for fire trucks and emergency vehicles in accordance with NFPA and UFC 3-600-1. Construct access drive(s) of asphalt or concrete pavement. Provide the emergency access drives with a minimum turning radius of 40 feet to accommodate fire vehicles. Restrict access to the emergency drive(s) by using removable bollards or metal pipe swing gates with a removable center bollard. Refer to the gate detail in Appendix J.

Paved access is required to mechanical rooms/yards. New curb and gutter shall be concrete paved.

6.4.4.2. Emergency Vehicle Access: Provide access drives to allow access for fire trucks and emergency vehicles in accordance with NFPA and UFC 3-600-1. Emergency access drives shall have minimum turning radii of 45 feet to accommodate fire vehicles. Access to the emergency drive(s) shall be restricted by using removable bollards or metal pipe swing gates with a removable center bollard. Refer to the gate detail in the drawings.

6.4.4.3. Concrete Hardstands for Vehicle Parking and Storage Areas: Develop a joint pattern plan showing locations of each type of joint to be used. Spot elevations are required at the intersection of each joint to facilitate placement of forms during construction.

6.4.5. Traffic Signage and Pavement Markings

6.4.5.1. Permanent and construction roadway signs shall be as required by the FHWA MUTCD and FHWA Standard Highway Signs.

6.4.5.2. Pavement markings and striping shall be in accordance with state DOT standards and the Manual of Uniform Traffic Control Devices (MUTCD). Channelization and pavement markings shall be as required by the FHWA MUTCD and FHWA Standard Highway Signs.

#### 6.4.6. Base Utility Information

(a) Do not place underground utility lines such as sanitary sewer, water, and gas under existing or proposed pavements. Place the utility between the back slope of a road ditch and building, or back of curb. Coordinate deviations to the aforementioned requirements with the COR. Do not locate above ground utility features in front of, or in such a manner as to detract from the facility, make landscaping more difficult, or restrict or negate close-in recreational areas. Do not locate high pressure gas lines closer than 100 feet from an occupied building without special protective provisions and COR approval.

(b) Coordinate and plan utility information with the Installation's DPW through the COR. The SDP provides existing utility routing and general orientation for points of connection. Specific connection locations not shown are noted hereinafter.

6.4.6.1. Connect all utilities from the building to the service connection points shown on the SDP or listed herein. Coordinate between the SDP and utility providers, as well as coordinating utility outages with the installation and service provider.

6.4.6.2. Water Distribution System: The water distribution system is shown on the SDP. Coordinate points of connection through the COR with the American Water Operations and Maintenance, Inc. Design and construction of potable water service between the main line and the facility shall be the responsibility of the Contractor. Design and install the water system and meter in accordance with the requirements of the American Water Operations and Maintenance, Inc. Install valves on the water service lines near the connection point and on each service line to the building. For water mains, provide 2 valves at tees and 3 valves at crosses. Velocities in water lines shall be less than 7 feet per second (fps) to prevent possible water hammer effects.

(a) Potable Water Disinfection – Verify water line disinfection per AWWA C651-05. Analyze the samples by an analytical lab that holds a current state license and certification. Repeating disinfection protocols per AWWA C651-05 is required until satisfactory results are obtained (two consecutive sets of acceptable samples taken 24 hours apart). Collect water samples in proper sterilized containers, and perform a bacterial examination in accordance with state approved methods. As a minimum, collect one water sample from each 1000 linear feet segment of disinfected water line. The water supply system disinfection is not approved for usage until each test result is negative for bacteriological examination. Provide the water sample analytical results to the DPW's Environmental Office for record keeping. The commercial laboratory shall be certified by the state's approving authority for examination of potable water.

6.4.6.3. Natural Gas Distribution: Natural Gas distribution lines are shown on the SDP. Coordinate points of connection to the facility with the installation DPW. The Installation DPW will provide natural gas service to the face of the building and shall install the site gas distribution piping. The Installation DPW shall install the gas meter and connect the meter to the building stub out. The contractor shall stub the gas feed out of the building. The Contractor is not responsible for costs incurred for services provided by the Installation DPW. Design and construct the natural gas service lines with ANSI B31.8, Gas Transmission Distribution and Piping Systems. Natural gas shall be provided to the building. Provide a meter/regulator assembly for the facility with a valved bypass.

6.4.6.4. Sanitary Sewer System: The sanitary sewer system is shown on the SDP. Coordinate points of connection through the COR with the DPW. Design and construct the sanitary sewer system in accordance with American Society of Civil Engineers (ASCE) and the Water Environment Federation (WEF), Gravity Sanitary Sewer Design and Construction, Second Edition (ASCE Manuals and Reports on Engineering Practice No. 60 / WEF Manual of Practice No. FD-5). Provide sanitary sewer service to the building. Install two-way cleanouts and all structures required by criteria, as well as, all piping between the designated point of connection and the building. Minimize the use of lift stations. If a lift station is required, provide a packaged unit assembled of coated materials that do not easily corrode. Provide an audible and visible alarm. Ensure location of lift station is accessible by service vehicles. Provide manholes at every change of direction and every 400 feet. Provide drop manholes if pipe elevations differ more than 18 inches. The minimum sewer main size shall be 8-inch. Provide 6-inch minimum sewer connections to buildings. Provide two-way cleanouts every 100 feet along a sewer branch connection from a building, and provide two-way cleanouts at the building connection. Construct manhole inlets of reinforced concrete or pre-cast reinforced concrete. Design structures in pavement to handle H-20 loading. Structures in

turfed areas can be constructed for lighter weight loading. Profiles are required for underground sanitary sewer systems.

6.4.6.5. Oil-Water Separators: Provide oil-water separators for the pretreatment of wastewater containing free-floating oils and grease prior to discharge into sanitary sewers. Additionally, determine the pretreatment limits required by the receiving wastewater utility and select or design a system to meet these discharge limits and to resist buoyant forces acting on the structure.

(a) Prepackaged Separators: The design shall consider the anticipated flow rate and the quantity of dirt and grit contained in the wastewater. High-volume wastewater containing large amounts of solids will usually require design of a cast-in-place separator.

(b) Cast-in-Place Separators: Cast-in-place reinforced concrete separators are required for the pretreatment of wastewater generated at outdoor facilities such as washracks. Provide a grit chamber either upstream of the separator, or integrally with the separator at the upstream end of the separator when large quantities of sediments are expected. In all cases, when the flow rate resulting from storm runoff significantly exceeds the normal operating flow rate, include a bypass in order to divert the storm water into the storm drainage system instead of allowing it to flow into the treatment system. Design cast-in-place oil/water separators to conform to Chapters 5 and 6 of the American Petroleum Institute's Manual on Disposal of Refinery Wastes. This manual provides minimum detention times. Provide slotted, rotation-type or belt type oil skimmer and waste oil storage tanks in accordance with user requirements.

6.4.6.6. Cable TV (CATV) Cable TV is privatized and provided by others. Privatized utility will provide design and service to the building(s) and is not in this contract.

#### 6.4.7. Cut and Fill

6.4.7.1. Strive to achieve a balanced cut and fill for earthwork. Do not waste excess soil within the SDP work area without the written approval of the Contracting Officer's Representative (COR).

#### 6.4.7.2. Grading Requirements:

(a) Finished Floor Elevations: A building's finished floor elevation shall be a minimum of 12 inches above the highest point of the adjacent outside finished grade, unless there is an overriding technical reason to deviate. Slope the finished grade a minimum of 5% for the first 10 feet away from the building.

(b) Turfed Areas Adjacent to Buildings: Slope outside finished grade away from the building at a 5% grade for the first 10 feet. Extend the 5% grade to 20 to 30 feet in areas with expansive soils. When site conditions require the use of steep slopes near buildings, provide a berm that is a minimum of 6 feet wide at a 5% grade adjacent to the building. Indicate these requirements on the grading plan with critical spot elevations.

(c) Lawn Areas: Lawn areas beyond the 5% finished grade stated above shall have a 1% minimum slope and a desirable maximum slope of 25%. If it becomes necessary to use slopes steeper than 25%, provide slope protection, but in no case shall the slope exceed 33%. Base the type and amount of slope protection provided on the soil type, slope length, and aesthetic, environmental, and economic considerations.

(d) Roads, Streets, and Access Drives: Gradients for roads, streets and access drives shall be as outlined in AASHTO, A Policy of Geometric Design of Highways and Streets. Accomplish grade changes in excess of 1% by means of vertical curves. Determine the length of vertical curves in accordance with the aforementioned AASHTO criteria. Profiles are mandatory for vertical control of centerline gradients. Show roads, streets and highways using of half-plan/half-profile type drawings.

(e) Parking Areas: Pavement grades shall provide positive surface drainage with a 1 percent minimum slope in the direction of drainage. Provide a maximum slope within a 90-degree parking space of 5 percent from front to rear end and 1-½ percent from side to side. Provide a maximum slope within a 45-degree or 60-degree parking space of 5 percent from front to rear end and 1 percent from side to side. Slope grade perpendicular to direction of parking 5 percent maximum for bituminous or concrete surfaces and 3 percent for other surfaces.

(f) Finish Grade Contours and Spot Elevations: Provide finish grade contours at 1-foot intervals and spot elevations to construct all site development features. Spot elevations on the drawings should be sufficient so that interpolation between contours is not required for structures, grading or paved areas. Provide spot elevations where grade changes a minimum of 1 percent and use at point of tangency for curbs on end islands and at corners of parking lots.

The Contractor shall strive to achieve a balanced cut and fill for earthwork.

#### 6.4.8. Borrow Material

Borrow areas are located off the installation. Waste earth shall be disposed of in the DPW material compound. Refer to the Installation Map, Appendix J Sheet G303 for location of the DPW Material Compound. The Contractor shall meet with DPW Environmental Office to determine stabilization requirements at waste disposal locations.

#### 6.4.9. Haul Routes and Staging Areas

6.4.9.1. See Appendix J, DRAWINGS for the project location and the location of haul routes and Contractor's staging area. Construction limits shall be confined to the construction site boundaries as shown on the Site Development Plan (SDP) within the Appendices.

6.4.9.2. The Contractor will be allotted an area as shown on the SDP for the placement of a construction trailer complex and storage for the Contractor and respective Subcontractors. Permanent Trailers are not permitted within the building envelope work areas. Trailers within the work area may be required to be relocated at no additional cost to the Government to accommodate site activities. The Contractor shall be responsible for the site preparation, fencing, access drives, and maintenance of the compound at all times. Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, remove the fence. . Restore areas used by the Contractor for the storage of equipment or material, or other use, to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary.

6.4.9.3. For proposal purposes, assume Contractor will be responsible for providing temporary utilities (water, sewer, and electricity, etc.) during construction at the project site. A water fill point will be provided as indicated on the SDP. It may be necessary, initially, for the Contractor to truck water to the project site until new utilities are constructed. Contractor is responsible for installation and maintenance of the haul road from the water fill point to the entrance of the construction site.. Coordinate routing of haul roads with the COR.

#### 6.4.10. Clearing and Grubbing:

The Contractor is responsible for clearing and grubbing operations as necessary within the limits of construction shown on the SDP.

#### 6.4.11. Landscaping:

(a) Provide native or well adapted species of plants in the landscaping plan. Choose trees, shrubs, and ground covers from the preferred plant list included in Appendix I. Provide shade trees . Use flowering vegetation at focal points to provide visual interest. All landscaping within 33 feet of the facility shall adhere to force protection clear zone requirements as specified in UFC 4-010-01.

(b) The landscaping integrated design shall emphasize the goal to achieve energy efficiency and water conservation. Select t vegetation based on hardiness, availability, and drought tolerance, which aids in the conservation of water, as well as, maintenance resources. Locate the trees to optimize shading opportunities, which aids in energy efficiency of the buildings by cooling during the summer.

(c) Landscape Irrigation.

Provide a subsurface drip irrigation system with programmable controls.

(d) Fort Hood has a 10 to 1 tree replacement policy. For every Natural Hardwood removed during construction the Contractor shall provide 10 trees in replacement.



(e) Provide landscaping to enhance the main entrances and the view of the Chapel Complex from the parking lots. Provide landscaping as a focal object to reinforce the architectural beauty of the Family Life Center.

#### 6.4.12. Turf:

Turfing shall be required on all graded, unpaved and disturbed areas resulting from the Contractor's operations. Sod shall be used in areas with steep slopes ( 3:1) or ditch linings to assist in establishing turf and to aid in erosion protection. Turf Reinforcement Matting (TRM) should be used in ditches that are subject to high velocity storm runoff. Erosion control matting shall also be utilized as necessary to control erosion on steeper slopes. When seed is used, prepare ground surface, spread a minimum of 3 inches of suitable topsoil, pre-fertilizer, sow seeds, hay much and anchor, water, mow and post-fertilize uniformly per manufacturer's recommendation. Sow seeds by means of drill machine seeders at the rate indicated by the seed manufacturer. Water all turfed areas as necessary for germination and continued growth. Maintain all areas by providing protection against traffic by erecting barricades and placing warning signs. Maintenance shall consist of water, replanting, re-mulching, mowing, maintaining existing grades, and repair of erosion damage. All areas shall be maintained until a cover of grass is achieved and meets the Storm Water Pollution Prevention requirement for stabilization.

#### 6.5. ARCHITECTURE

6.5.1. General: To the maximum extent possible within the contract cost limitation, the buildings shall conform to the look and feel of the architectural style and shall use the same colors as adjacent facilities as expressed herein . The Government will evaluate the extent to which the proposal is compatible with the architectural theme expressed in the RFP during the contract or task order competition. The first priority in order of importance is that the design provides comparable building mass, size, height, and configuration compared to the architectural theme expressed herein. The second priority is that design is providing compatible exterior skin appearance based upon façade, architectural character (period or style), exterior detailing, matching nearby and installation material/color pallets, as described herein.

#### 6.5.2. Design

6.5.2.1. Appendix F is provided "For Information Only", to establish the desired site and architectural themes for the area. Appendix F identifies the desired project look and feel based on **Fort Hood's** Installation Architectural Theme from existing and proposed adjacent building forms; i.e. building exterior skin, roof lines, delineation of entrances, proportions of fenestration in relation to elevations, shade and shadow effects, materials, textures, exterior color schemes, and organizational layout.

6.5.2.2. The design should address Fort Hood's identified preferences. Implement these preferences considering the following:

- (a) Achievable within the Construction Contract Cost Limitation (CCL)
- (b) Meets Milestones within Maximum Performance Duration.
- (c) Achieves Full Scope identified in this Solicitation
- (d) Best Life-Cycle Cost Design
- (e) Meets the Specified Sustainable Design and LEED requirements.
- (f) Complies with Energy Conservation Requirements Specified in this RFP.

6.5.2.3. Priority #1. Visual Compatibility: Facility Massing (Size, Height, Spacing, Architectural Theme, etc.) Exterior Aesthetic Considerations: The buildings massing, exterior functional aesthetics, and character shall create

a comprehensive and harmonious blend of design features that are sympathetic to the style and context of the Installation. The Installation's intent for this area is:

Provide facilities that conform to the look and feel of the architectural style of the adjacent Chapel Complex and Religious Education Facility to the maximum extent possible within the Contract Cost Limitation (CCL). Provide the identical exterior colors. Provide interior colors that are also generally identical, except where paragraph 3 series descriptions identify intended exceptions. The architectural style includes such issues as building mass, "line" heights (belt courses, window tops, etc.), roof lines, shade-and-shadow effects, organizational layout, materials (not specific brands), textures, fenestration, and thematic detailing. Provide this architectural style in such a manner that the facilities from this project appear to be directly related to the adjacent Chapel Complex and Religious Education Facility and that the suite of buildings clearly appears as a well coordinated complex. Photographs, illustrations and descriptions contained in Appendix F, Photos of Surrounding Buildings is provided as an additional guide to the offerer and includes renderings of the adjacent Chapel Complex and Religious Education Facility. Provide facilities that are achievable within the CCL, that will perform for the maximum time duration, and that will exhibit the best life cycle and sustainability characteristics. Provide door hardware that coordinates with Fort Hood's existing keying system.

6.5.2.4. Priority #2. Architectural Compatibility: Exterior Design Elements (Materials, Style, Construction Details, etc.) Roofs, Exterior Skin, and Windows & Door Fenestrations should promote a visually appealing compatibility with the desired character while not sacrificing the integrity and technical competency of building systems.

6.5.2.5. See Appendix F for exterior colors that apply to Architectural character at Fort Hood. The manufacturers and materials referenced are intended to establish color only, and are not intended to limit manufacturers and material selections.

6.5.2.6. Additional architectural requirements:

(a) Install fall protection anchor points on all roofs with a slope greater than 2:12

6.5.3. Programmable Electronic Key Card Access Systems:

Not Required.

6.5.4. INTERIOR DESIGN

See paragraphs 3 and 4.

Interior building signage requirements:

See paragraphs 3 and 4.

6.6. STRUCTURAL DESIGN

6.6.1. General

Analyze, design, and detail each building as a complete structural system. Design structural elements to preclude damage to finishes, partitions, and other frangible, nonstructural elements; to prevent impaired operability of moveable components; and to prevent cladding leakage and roof ponding. Limit deflections of structural members to the allowable of the applicable material standard, e.g. ACI, AISC, Brick Industry Association (BIA).

Place floor mounted mechanical and electrical equipment on a 4" minimum concrete pad.

6.6.2. Project Specific Design Loads:

6.6.2.1. Wind Speed: 90 mph

6.6.2.2. Seismic Design Data: The mapped maximum considered earthquake (MCE) spectral response accelerations for site class B are:

$S_s$  (at short periods) = 8% g

$S_1$  (at 1-second period) = 4% g.

The acceleration values identified are for the general location of the facility. Verify and use site specific criteria based on the final site location of the facility. Adjust site class per IBC to match specific site information in geotechnical report.

6.6.2.3. For design of structural components subjected to dynamic loads, the U.S. Army Corps of Engineers Protective Design Center (PDC) developed SBEDS, Single-Degree-of-Freedom Blast Effects Design Spreadsheets (SBEDS). SBEDS is available at the software tab of the PDC website, <https://pdc.usace.army.mil/>.

#### 6.6.3. Foundation

Coordinate the need for a vapor barrier with the architectural floor finishes and requirements of the geotechnical report. Use a a vapor barrier system with a minimum 10-mil polyethylene membrane under all slab-on-grade to receive a coating (e.g. epoxy) or to receive an overlaying finish (e.g. carpet or tile).

#### 6.6.4. Site Features – Retaining Walls/Bridges/etc.

Design site features, e.g. retaining walls, culverts, bridges, in accordance with the appropriate American Association of State Highway and Transportation Officials (AASHTO) criteria including AASHTO LRFD Bridge Design Specifications, AASHTO Standard Specifications for Highway Bridges, and AASHTO Guide Specifications for Design of Pedestrian Bridges. Consider operation and maintenance requirements, e.g. painting, mowing, inspecting, routine maintenance. Design site features to drain properly in order to meet loading assumptions.

#### 6.7. THERMAL PERFORMANCE

Consider moisture protection . Consider protection from damage to flooring and wall finishes when designing floor slabs and walls. This could be as simple as placing a vapor barrier under the floor slab, building wrap, or vapor barrier on the walls.

#### 6.8. PLUMBING

No additional requirements.

#### 6.9. SITE ELECTRICAL AND TELECOMMUNICATIONS SYSTEMS

6.9.1. Derive electrical service from the existing aerial 7200/12,470 Volt primary service located as shown on the exterior power plans in Appendix J. Primary service shall be 3-phase. Coordinate construction associated with the removal of the existing and the installation of the new primary electrical system and communication systems at the site with the Fort Hood DPW. Perform all work on existing systems “hot” unless permission is obtained in advance from the contracting officer and Fort Hood DPW. Obtain permission for any connections a minimum of 72 hours in advance from the contracting officer and Fort Hood DPW. All underground electrical shall be in conduit, and all underground primary shall be concrete encased with red concrete. For secondary system, utilize marker tape – minimum 12 inches below finished grade – except in isolated areas.

- (a) Jack and bore all road crossings . Open cuts are not permissible.
- (b) If outages are unavoidable, schedule them with the DPW no less than two weeks in advance.
- (c) Coordinate all communications work through the Ft. Hood DOIM.
- (d) Transformers shall be pad mounted and loop fed with load break switches (3-2 position).

6.9.2. Install an aerial to underground transition with fused cutout switch at the power riser pole. Use 15 KV primary conductors for primary service. Provide one spare 4" conduit for future primary.

- (a) Use armor rods rather than ties for connection of conductors to pin insulators.
- (b) Use heavy air switches with arc snuffers for all branch distribution circuits that serve multiple buildings.
- (c) Provide fiberglass guy insulators for all guys that come in proximity to phase conductors.
- (d) Use three quarter inch minimum size bolts for pole hardware.
- (e) Use spring washers under all hardware bolts including cross-arms.
- (f) Use flat metal braces or wood braces for #4 ACSR conductors and smaller. Use angle braces for conductors larger than #4 ACSR.
- (g) Provide at least one thru-bolt for all pole-mounted floodlights. Do not use lag bolts.
- (h) Use metal gains for all cross-arms that do not come pre-gained.
- (i) Use arm construction rather than armless construction for phase 3 aerial lines and equipment poles.
- (j) Use minimum three quarter inch ground rods.
- (k) Use ACSR aluminum rather than copper for all aerial conductors with minimum size of #4 AWG.
- (l) At the pole mounted overhead to underground transition, use wet process porcelain terminators rather than elastomeric terminators.
- (m) Use the two bushing aerial pole mount transformers rather than the self-protected (lightning arrester) terminators,
- (n) Connect line to lightning arrester to cutout rather than from line to cutout and jumper to lightning arrester.
- (o) Provide 29 foot clearance of electrical high voltage lines at street crossing.

6.9.3. Lighting: Provide power for all required site lighting to include parking lot lighting from the new facility. Site lighting shall be pulse-start metal-halide (PSMH) or induction type. Operate lighting off of a lighting contactor and shall be 480 volt where available.

6.9.4. Provide for demolition (if necessary) as noted on the exterior power plans in Appendix J.

6.9.5. Provide electric meter mounted to the pad mounted transformer. Electrical watt-hour demand meters at Ft. Hood shall be encoded type, electromechanical type conforming to ANSI C12.10 and equipped with an electronic pulse initiator, or an electronic type meter with pulse output. Pulse type meters shall be capable of operating at speeds up to 500 pulses per minute with no false pulses and shall provide a pulse output of one pulse per kilowatt-hour. Supply all programming device or software required for programming with the meter. Further requirements for metering are included in the appendices for Metering Requirements.

6.9.6. Telecommunications Install all communications cabling in ducts as shown on the exterior communications plans in Appendix J. Where 1" inner duct is required per the drawings, do not extend the inner duct more than 4" beyond the entrance and exit ducts within manholes. Install nylon pull cord in all empty conduits. Outside plant cables to the new facility shall consist of 1-12 strand single mode fiber optic cable installed in a 1" inner duct and 150 pairs copper cabling in a 4" duct. Coordinate all associated work and requirements including final location of duct banks and manholes with Fort Hood DOIM thru the contracting officer's representative and Fort Hood DPW.

6.9.6.1. Use concrete encased duct banks.

6.9.6.2. Core drill existing MHs.

6.9.6.3. Ducts entering MHs shall start at the bottom of the wall and work up.

## 6.10. FACILITY ELECTRICAL AND TELECOMMUNICATIONS SYSTEMS

6.10.1. Telecommunications:

6.10.2. Cable TV (CATV):

6.10.2.1. Leave ten feet of slack cable in the telecommunications room at a location designated for the CATV box. Homerun all cabling throughout the building back to the main telecommunications room to allow for just one connectivity point to the outside cable provided by the local CATV company. All CATV cabling shall be RG6 Quad shield, and all CATV cabling shall be tested for operability.

6.10.2.2. Covers for CATV outlets shall match electrical and other outlet plates; either white or ivory plastic. Mismatched colors are unacceptable.

6.10.3. Metering: All electrical and water meters shall include ability to interface and connect to the installation's existing LonWorks network. The controls contractor is responsible for final connection of the gas, water, and electric meters to the ILON 600 – making data points available to the EMCS.

6.10.4. Mount motor starters at 4 foot above flood level for ease of maintenance.

## 6.11. HEATING, VENTILATING, AND AIR CONDITIONING

Integrate the control system to the installation's existing UMCS. The existing UMCS is LonWorks, and utility meters shall be LonWorks certified.

## 6.12. ENERGY CONSERVATION

6.12.1. Inclusion of Renewable Energy Features. The following renewable energy features have been determined lifecycle cost effective, are included in the project budget and shall be provided:

(a) Designers will consider passive solar systems, hybrid or combined passive / active solar systems, and other solar systems that can be reasonably evaluated and that are practicable.

(b) Active solar hot water heating shall be considered. Systems shall be freeze-proofed either with an automatic drain down function or a glycol solution combined with a heat exchanger.

(c) Solar pre-heating should be considered for hydronic heating systems.

## 6.13. FIRE PROTECTION

6.13.1. Verify the hydrant flow test data listed in appropriate Appendix prior to design of the building fire protection sprinkler system.

6.13.2. The Fire Alarm Control Panel shall be fully compatible with the existing Monaco presently in use at Fort Hood.

6.13.3. Fire Alarm System: Fire alarm systems shall be Class A looped.

6.13.3.1. The RF Transceiver shall be compatible with the Fire Department receiving system, operating on an RF frequency.

(a) The receiver shall be equivalent to a Monaco BT-X, D-700 or D-800 operating on a frequency of 139.3750 MHz.

(b) The installation fire alarm receiving system is a Monaco system.

6.13.3.2. Fire alarm pull stations shall have CAT-15 key lock and reset, and they should not utilize break glass, rods, or special tools to reset.

6.13.3.3. Fire alarm control panel shall have a CAT-15 key lock.

6.13.3.4. Paint fire lanes provide appropriate signage in compliance with applicable building codes, ADA, and UFAS.

6.13.3.5. All special tools, software, connecting cables, and proprietary equipment necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the Contracting Officer Representative.

#### 6.13.4. Mass Notification System (MNS)

6.13.4.1. Connect the building MNS to the Mass Notification Card of Monaco BT-XM transceiver, installed for the Fire Alarm System. Connect the MNS panel to the BT-XM transceiver for future Monaco D-21 control of the MNS. Key the MNS panel as CAT 60.

6.13.4.2. Program the following 4 messages into the system:

(a) FIRE (Siren X 5 Seconds) (Female voice) "ATTENTION, ATTENTION, A FIRE EMERGENCY HAS BEEN REPORTED. PLEASE REMAIN CALM AND EXIT THE BUILDING USING THE NEAREST EXIT".

(b) WEATHER (100 KHZ Steady tone X 5 Seconds) (Female voice) "THE NATIONAL WEATHER SERVICE HAS ISSUED A SEVERE WEATHER ALERT FOR THIS AREA. TUNE TO LOCAL RADIO AND TELEVISION STATIONS FOR FURTHER GUIDANCE".

(c) SUSPICIOUS ACTIVITY (Fast whoop X 5 Seconds) (Female voice) "MAY I HAVE YOUR ATTENTION PLEASE! A POSSIBLE BREACH IN SECURITY HAS BEEN REPORTED. PLEASE REMAIN CALM. YOU ARE INSTRUCTED TO TAKE APPROPRIATE SECURITY MEASURES AND TO REPORT SUSPICIOUS PERSONNEL, VEHICLES, PACKAGES OR ACTIVITIES TO SECURITY PERSONNEL".

(d) TOXIC CHEMICAL HAZARD EMERGENCY (Chime tone X 5 Seconds) (Female Voice) "MAY I HAVE YOUR ATTENTION PLEASE! A TOXIC CHEMICAL HAZARD HAS BEEN REPORTED, PLEASE REMAIN CALM AND TAKE APPROPRIATE MEASURES TO AVOID THE HAZARD".

#### 6.14. SUSTAINABLE DESIGN

6.14.1. LEED Rating Tool Version. This project shall be executed using LEED-NC Version 3.

6.14.2. The minimum requirement for this project is to achieve LEED Silver level. Each non-exempt facility (building plus sitework) must achieve this level. In addition to any facilities indicated as exempt in paragraph 3, the following facilities are exempt from the minimum LEED achievement requirement: Not Applicable..

6.14.3. Credit Validation: LEED registration, compiling of documentation at LEED OnLine and use of the LEED Letter Templates is required. Registration and payment of registration fees will be by the Government. Administration/team management of the online project will be by the Contractor. Validation of credits will be accomplished by the Government. LEED certification of the project by the Contractor is required. The Contractor will obtain LEED certification prior to project closeout. Application, payment of certification of fees and all coordination with USGBC during the certification process will be by the Contractor. GBCI interim review of design phase data is not required by the Government but is recommended. Government validation during project execution does not relieve or modify in any way the Contractor's responsibility to satisfy all requirements for certification as defined by LEED and GBCI. Contractor is not responsible for design phase LEED documentation of any unaltered portion of the design that is accomplished by others. If the project includes unaltered complete design by others, during the certification process Contractor will coordinate all GBCI comments on LEED credits that fall outside Contractor's scope of responsibility with the Government for coordination with the Designer of Record, and Contractor will not be penalized if project fails to achieve certification at the minimum required level due to loss of credits that are the responsibility of others.

6.14.4. Commissioning: See Appendix M for Owner's Project Requirements document(s).

6.14.5. LEED Credits Coordination. The following information is provided relative to Sustainable Sites and other credits.

#### **SS Credit 1 Site Selection:**

Project site IS NOT considered prime farmland.

Delineation of 100-year flood elevation is shown on site drawings provided in this CONTRACT.

Delineation of threatened or endangered species habitat is shown on site drawings provided in this CONTRACT.

Delineation of water, wetlands and areas of special concern is shown on site drawings provided in this CONTRACT.

Project site WAS NOT previously used as public parkland.

**SS Credit 2 Development Density & Community Connectivity.**

Project site DOES NOT meets the criteria for this credit.

**SS Credit 3 Brownfield Redevelopment.**

Project site DOES NOT meets the criteria for this credit.

**SS Credit 4.1 Public Transportation Access.**

Project site DOES NOT meets the criteria for this credit.

**EA Credit 6 Green Power.**

35% of the project's electricity WILL NOT will be provided through an Installation renewable energy contract. Do not purchase Renewable Energy Credits (REC's) to earn this credit.

**MR Credit 2 Construction Waste Management.**

The Installation does not have an on-post recycling facility available for Contractor's use.

**Regional Priority Credits (Version 3 only)**

The project zip code is 76544.

6.14.6. LEED Credit Preferences, Guidance and Resources. See Appendix L LEED Project Credit Guidance for supplemental information relating to individual credits.

6.14.7. Not Used

6.14.8. Additional Information

The Source Selection Evaluation Board (SSEB) will consider it a strength if an offeror proposes to \*certify\* the project with LEED. The SSEB will also consider it a strength if an offeror proposes 40% or more energy efficiency above ASHRAE standards.

6.15. ENVIRONMENTAL

NO ADDITIONAL REQUIREMENTS

6.16. PERMITS

There are no additional items of permit information or requirements included here. See Appendix II - Special Fort Hood Requirements.

6.17. DEMOLITION

There is no site demolition required.

6.18. ADDITIONAL FACILITIES

No additional facilities are required.

End of Section 01 10 00



**SECTION 01 32 01.00 10**  
**PROJECT SCHEDULE**

**1.0 GENERAL**

1.1. REFERENCES

1.2. QUALIFICATION

**2.0 PRODUCTS (NOT APPLICABLE)**

**3.0 EXECUTION**

3.1. GENERAL REQUIREMENTS

3.2. BASIS FOR PAYMENT AND COST LOADING

3.3. PROJECT SCHEDULE DETAILED REQUIREMENTS

3.4. PROJECT SCHEDULE SUBMISSIONS

3.5. SUBMISSION REQUIREMENTS

3.6. PERIODIC SCHEDULE UPDATE MEETINGS

3.7. REQUESTS FOR TIME EXTENSIONS

3.8. DIRECTED CHANGES

3.9. WEEKLY PROGRESS MEETINGS

3.10. OWNERSHIP OF FLOAT

3.11. TRANSFER OF SCHEDULE DATA INTO RMS/QCS

## **1.0 GENERAL**

### **1.1. REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

- U.S. ARMY CORPS OF ENGINEERS (USACE) ER 1-1-11 (1995) Progress, Schedules, and Network Analysis Systems <http://www.usace.army.mil/publications/eng-regs/er1-1-11/entire.pdf>
- Army Corps of Engineers ECB No. 2005-10, (31 August 2005) Scheduling Requirements for Testing of Mechanical Systems in Construction [http://www.wbdg.org/ccb/ARMYCOE/COEECB/ecb\\_2005\\_10.pdf](http://www.wbdg.org/ccb/ARMYCOE/COEECB/ecb_2005_10.pdf)

### **1.2. QUALIFICATIONS**

The Contractor shall designate an authorized representative who shall be responsible for the preparation of the schedule and all required updating (statusing) and preparation of reports. The authorized representative shall be experienced in scheduling projects similar in nature to this project and shall be experienced in the use of the scheduling software that meets the requirements of this specification.

## **2.0 PRODUCTS (Not Applicable)**

## **3.0 EXECUTION**

### **3.1. GENERAL REQUIREMENTS**

3.1.1. Submit a project schedule as specified herein for approval showing the sequence in which the Contractor proposes to perform the work and dates on which the Contractor contemplates starting and completing all schedule activities. The scheduling of the entire project, including the design and construction sequences is required. Contractor management personnel shall actively participate in its development. Designers, subcontractors and suppliers working on the project shall also contribute in developing an accurate project schedule. The schedule must be a forward planning as well as a project monitoring tool. The approved project schedule shall be used to measure the progress of the work and to aid in evaluating requests for excusable time extensions. The schedule shall be cost loaded and activity coded as specified herein. The schedule will provide the basis for all progress payments. If the Contractor fails to submit any schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule

3.1.2. Status the schedule on at least a monthly basis, as specified herein. If in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained. See paragraph 3.7.4.

3.1.3. Failure of the Contractor to comply with the requirements of the Contracting Officer shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of the contract.

### **3.2. BASIS FOR PAYMENT AND COST LOADING**

The schedule shall be the basis for determining contract earnings during each update period and therefore the amount of each progress payment. Lack of an approved schedule update or qualified scheduling personnel will result in an inability of the Contracting Officer to evaluate contract earned value for the purposes of payment. Failure of the Contractor to provide all information, as specified herein will result in the disapproval of the preliminary, initial and subsequent schedule updates. In the event schedule revisions are directed by the Contracting Officer and those revisions have not been included in subsequent revisions or updates, the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until such revisions to the

project schedule have been made. Activity cost loading shall be reasonable as determined by the Contracting Officer. The aggregate value of all activities coded to a contract CLIN as specified herein shall equal the value of the CLIN on the Schedule.

### 3.3. PROJECT SCHEDULE DETAILED REQUIREMENTS

The computer software system utilized to produce and update the project schedule shall be capable of meeting all requirements of this specification. Failure of the Contractor to meet the requirements of this specification will result in the disapproval of the schedule. Scheduling software that meets the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER-1-1-11(1995) referenced herein are Primavera Project Planner (P3) by Primavera, and Open Plan by Deltek.

#### 3.3.1. Use of the Critical Path Method

Use the Critical Path Method (CPM) of network calculation to generate the project schedule. Prepare the project schedule using the Precedence Diagram Method (PDM).

#### 3.3.2. Level of Detail Required

Develop the project schedule to an appropriate level of detail. Failure to develop the project schedule to an appropriate level of detail, as determined by the Contracting Officer, will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

##### 3.3.2.1. Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities shall have Original Durations (OD) greater than 20 work days or 30 calendar days. Procurement activities are defined herein.

##### 3.3.2.2. Design and Permit Activities

Design and permit activities, including necessary conferences and follow-up actions and design package submission activities shall be included. The Contractor shall include the design schedule in the project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific contract period. This shall be at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. The schedule shall include review and correction periods associated with each item.

##### 3.3.2.3. Procurement Activities

The schedule must include activities associated with the submittal, approval, procurement, fabrication and delivery of long lead materials, equipment, fabricated assemblies and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days. A typical procurement sequence includes the string of activities: submit, approve, procure, fabricate, and deliver.

##### 3.3.2.4. Mandatory Tasks

The following tasks must be included and properly scheduled:

- 3.3.2.4.1. Submission, review and acceptance of design packages
- 3.3.2.4.2. Submission of mechanical/electrical/information systems layout drawings
- 3.3.2.4.3. Submission and approval of O & M manuals
- 3.3.2.4.4. Submission and approval of as-built drawings
- 3.3.2.4.5. Submission and approval of 1354 data and installed equipment lists

- 3.3.2.4.6. Submission and approval of testing and air balance (TAB)
- 3.3.2.4.7. Submission of TAB specialist design review report
- 3.3.2.4.8. Submission and approval of fire protection specialist
- 3.3.2.4.9. Submission and approval of testing and balancing of HVAC plus commissioning plans and data. Develop the schedule logic associated with testing and commissioning of mechanical systems to a level of detail consistent with Engineering and Construction Bulletin (ECB) No. 2005-10 dated 31 August 2005.
- 3.3.2.4.10. Air and water balancing
- 3.3.2.4.11. HVAC commissioning
- 3.3.2.4.12. Controls testing plan submission
- 3.3.2.4.13. Controls testing
- 3.3.2.4.14. Performance Verification testing
- 3.3.2.4.15. Other systems testing, if required
- 3.3.2.4.16. Contractor's pre-final inspection
- 3.3.2.4.17. Correction of punch list from Contractor's pre-final inspection
- 3.3.2.4.18. Government's pre-final inspection
- 3.3.2.4.19. Correction of punch list from Government's pre-final inspection
- 3.3.2.4.20. Final Inspection

#### 3.3.2.5. Activity Responsibility Coding (RESP)

Assign Responsibility Code for all activities to the Prime Contractor, Subcontractor or Government agency responsible for performing the activity. Activities coded with a Government Responsibility code include, but are not limited to: Government approvals, Government design reviews, environmental permit approvals by State regulators, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements. Code all activities not coded with a Government Responsibility Code to the Prime Contractor or Subcontractor responsible to perform the work. Activities shall not have more than one Responsibility Code. Examples of acceptable activity code values are: DOR (for the designer of record); ELEC (for the electrical subcontractor); MECH (for the mechanical subcontractor); and GOVT (for USACE). Unacceptable code values are abbreviations of the names of subcontractors.

#### 3.3.2.6. Activity Work Area Coding (AREA)

Assign Work Area code to activities based upon the work area in which the activity occurs. Define work areas based on resource constraints or space constraints that would preclude a resource, such as a particular trade or craft work crew from working in more than one work area at a time due to restraints on resources or space. Examples of Work Area Coding include different areas within a floor of a building, different floors within a building, and different buildings within a complex of buildings. Activities shall not have more than one Work Area Code. Not all activities are required to be Work Area coded. A lack of Work Area coding will indicate the activity is not resource or space constrained.

#### 3.3.2.7. Contract Changes/Requests for Equitable Adjustment (REA) Coding (MODF)

Assign Activity code to any activity or sequence of activities added to the schedule as a result of a Contract Modification, when approved by Contracting Officer, with a Contract Changes/REA Code. Key all Code values to the Government's modification numbering system.

Any activity or sequence of activities added to the schedule as a result of alleged constructive changes made by the Government may be added to a copy of the current schedule, subject to the approval of the Contracting Officer. Assign Activity codes for these activities with a Contract Changes/REA Code. Key the code values to the Contractor's numbering system. Approval to add these activities does not necessarily mean the Government accepts responsibility and therefore liability for such activities and any associated impacts to the schedule, but rather the Government recognizes such activities are appropriately added to the schedule for the purposes of maintaining a realistic and meaningful schedule. Such activities shall not be Responsibility Coded to the Government unless approved. An activity shall not have more than one Contract Changes/REA Code

#### 3.3.2.8. Contract Line Item (CLIN) Coding (BIDI)

Code all activities to the CLIN on the Contract Line Item Schedule to which the activity belongs. An activity shall not contain more than one CLIN Item Code. CLIN Item code all activities, even when an activity is not cost loaded.

#### 3.3.2.9. Phase of Work Coding (PHAS)

Assign Phase of Work Code to all activities, based upon the phase of work in which the activity occurs. Code activities to either a Design Phase or a Construction Phase. Code fast track design and construction phases proposed by the Contractor to allow filtering and organizing the schedule by fast track design and construction packages. If the contract specifies construction phasing with separately defined performance periods, identify a Construction Phase Code to allow filtering and organizing the schedule accordingly. Each activity shall have only one Phase of Work code.

#### 3.3.2.10. Category of Work Coding (CATW)

Assign Category of Work code to all Activities based upon the category of work which the activity belongs. Category of Work Code must include, but is not limited to: Design, Design Submittal, Construction Submittal, Approval, Acceptance, Procurement, Fabrication, Delivery, Weather Sensitive Installation, Non-Weather Sensitive Installation, Start Up, Test, and Turnover. Assign a Category of Work code to each activity. Each activity shall have only one Category of Work Code.

#### 3.3.2.11. Definable Features of Work Coding (FOW1, FOW2, FOW3)

Assign a Definable Feature of Work Code to appropriate activities based on the definable feature of work to which the activity belongs. Definable Feature of Work is defined in Specification Section 01 45 04.00 10, Contractor Quality Control. An activity shall not have more than one Definable Feature of Work Code. Not all activities are required to be Definable Feature of Work Coded.

### 3.3.3. Scheduled Project Completion and Activity Calendars

The schedule interval shall extend from NTP date to the required contract completion date. The contract completion activity (End Project) shall finish based on the required contract duration in the accepted contract proposal, as adjusted for any approved contract time extensions. The first scheduled work period shall be the day after NTP is acknowledged by the Contractor. Schedule activities on a calendar to which the activity logically belongs. Activities may be assigned to a 7 day calendar when the contract assigns calendar day durations for the activity such as a Government Acceptance activity. If the Contractor intends to perform physical work less than seven days per week, schedule the associated activities on a calendar with non-work periods identified including weekends and holidays. Assign the Category of Work Code - Weather Sensitive Installation to those activities that are weather sensitive. Original durations must account for anticipated normal adverse weather. The Government will interpret all work periods not identified as non-work periods on each calendar as meaning the Contractor intends to perform work during those periods.

#### 3.3.3.1. Project Start Date

The schedule shall start no earlier than the date on which the NTP was acknowledged. Include as the first activity in the project schedule an activity called "Start Project" or "NTP". The "Start Project" activity shall have an "ES" constraint date equal to the date that the NTP was acknowledged, with a zero day duration.

#### 3.3.3.2. Schedule Constraints and Open Ended Logic

Constrain completion of the last activity in the schedule by the contract completion date. Schedule calculations shall result in negative float when the calculated early finish date of the last activity is later than the contract completion date. Include as the last activity in the project schedule an activity called "End Project". The "End Project" activity shall have an "LF" constraint date equal to the contract completion date for the project, and with a zero day duration or by using the "project must finish by" date in the scheduling software. The schedule shall have no constrained dates other than those specified in the contract. The use of artificial float constraints such as "zero free float" or "zero total float" are typically prohibited. There shall only be 2 open ended activities: Start Project (or NTP) with no predecessor logic and End Project with no successor logic.

#### 3.3.3.3. Early Project Completion

In the event the Preliminary or Initial project schedule calculates an early completion date of the last activity prior to the contract completion date, the Contractor shall identify those activities that it intends to accelerate and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. The last activity shall have a late finish constraint equal to the contract completion date and the schedule will calculate positive float. The Government will not approve an early completion schedule with zero float on the longest path. The Government is under no obligation to accelerate activities for which it is responsible to support a proposed early contract completion.

#### 3.3.4. Interim Completion Dates

Constrain contractually specified interim completion dates to show negative float when the calculated early finish date of the last activity in that phase is later than the specified interim completion date.

##### 3.3.4.1. Start Phase

Include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have an "ES" constraint date equal to the date on which the NTP was acknowledged, and a zero day duration.

##### 3.3.4.2. End Phase

Include as the last activity for a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" constraint date equal to the specified completion date for that phase and a zero day duration.

##### 3.3.4.3. Phase "X" Hammock

Include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" hammock activity shall be logically tied to the earliest and latest activities in the phase.

#### 3.3.5. Default Progress Data Disallowed

Do not automatically update Actual Start and Finish dates with default mechanisms that may be included in the scheduling software. Activity Actual Start (AS) and Actual Finish (AF) dates assigned during the updating process shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the AS and AF dates on the Daily Quality Control report for every in-progress or completed activity, and failure to ensure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's updated schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. Updating of the percent complete and the remaining duration of any activity shall be independent functions. Disable program features which calculate one of these parameters from the other.

#### 3.3.6. Out-of-Sequence Progress

Activities that have progressed before all preceding logic has been satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case basis subject to approval by the Contracting Officer. Propose logic corrections to eliminate all out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule. Correct out of sequence progress that continues for more than two update cycles by logic revision, as approved by the Contracting Officer.

### 3.3.7. Negative Lags and Start to Finish Relationships

Lag durations contained in the project schedule shall not have a negative value. Do not use Start to Finish relationships (SF).

### 3.3.8. Calculation Mode

Schedule calculations shall retain the logic between predecessors and successors even when the successor activity starts and the predecessor activity has not finished. Software features that in effect sever the tie between predecessor and successor activities when the successor has started and the predecessor logic is not satisfied ("progress override") will not be allowed.

### 3.3.9. Milestones

The schedule must include milestone activities for each significant project event including but not limited to: milestone activities for each fast track design package released for construction; design complete; foundation/substructure construction complete; superstructure construction complete; building dry-in or enclosure complete to allow the initiation of finish activities; permanent power complete; and building systems commissioning complete.

## 3.4. PROJECT SCHEDULE SUBMISSIONS

Provide the submissions as described below. The data CD, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

### 3.4.1. Preliminary Project Schedule Submission

Submit the Preliminary Project Schedule, defining the Contractor's planned operations for the first 90 calendar days for approval within 15 calendar days after the NTP is acknowledged. The approved Preliminary Project Schedule will be used for payment purposes not to exceed 90 calendar days after NTP. Completely cost load the Preliminary Project Schedule to balance the contract award CLINS shown on the Price Schedule. Detail it for the first 90 calendar days. It may be summary in nature for the remaining performance period. It must be early start and late finish constrained and logically tied as previously specified. The Preliminary Project Schedule forms the basis for the Initial Project Schedule specified herein and must include all of the required Plan and Program preparations, submissions and approvals identified in the contract (for example, Quality Control Plan, Safety Plan, and Environmental Protection Plan) as well as design activities, the planned submissions of all early design packages, permitting activities, design review conference activities and other non-construction activities intended to occur within the first 90 calendar days. Schedule any construction activities planned for the first 90 calendar days after NTP. Constrain planned construction activities by Government acceptance of the associated design package(s) and all other specified Program and Plan approvals. Activity code any activities that are summary in nature after the first 90 calendar days with Responsibility Code (RESP) and Feature of Work code (FOW1, FOW2, FOW3)

### 3.4.2. Initial Project Schedule Submission

Submit the Initial Project Schedule for approval within 42 calendar days after NTP. The schedule shall demonstrate a reasonable and realistic sequence of activities which represent all work through the entire contract performance period. The Initial Schedule shall be at a reasonable level of detail as determined by the Contracting Officer. The schedule shall include detailed design and permitting activities, including but not limited to identification of individual design packages, design submission, reviews and conferences; permit submissions and any required Government actions; and long lead procurement activities required prior to design completion. The Initial Project Schedule shall include the entire construction sequence and all fast track construction activities, with as much detail as is known at the time but, as a minimum, shall include all construction start and completion milestone activities, and detailed construction activities through the dry-in milestone, including all activity coding and cost loading. Include the remaining construction, including cost loading, but it may be scheduled summary in nature. As the design proceeds and design packages are developed, fully detail the remaining construction activities concurrent with the monthly schedule updating process. Constrain construction activities by Government acceptance of associated designs. When the design is complete, incorporate into the then approved schedule update all remaining detailed construction activities that are planned to occur after the dry-in milestone.

### 3.4.3. Design Package Schedule Submission:

With each design package submitted to the Government, submit a frag-net schedule extracted from the then current Preliminary, Initial or Updated schedule which covers the activities associated with that Design Package including construction, procurement and permitting activities.

### 3.4.4. Periodic Schedule Updates

Based on the result of the meeting specified in PERIODIC SCHEDULE UPDATE MEETINGS, submit periodic schedule updates. These submissions shall enable the Contracting Officer to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgment of the Contracting Officer or authorized representative is necessary for verifying the Contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made. Update the schedule to include detailed procurement and construction activities as the design progresses, but not later than the submission of the final, un-reviewed design submission for each separate design package. The Contracting Officer may require submission of detailed schedule activities for any distinct construction that is started prior to submission of a final design submission, if such activity is authorized.

### 3.4.5. Standard Activity Coding Dictionary

Use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11, Appendix A. This exact structure is mandatory, even if some fields are not used. A template SDEF compatible schedule backup file (sdef.prx) is available on the QCS website: [www.rmssupport.com](http://www.rmssupport.com). The SDEF format is as follows:

Field	Activity Code	Length	Description
1	WRKP	3	Workers per Day
2	RESP	4	Responsible Party (e.g. GC, subcontractor, USACE)
3	AREA	4	Area of Work
4	MODF	6	Modification or REA number
5	BIDI	6	Bid Item (CLIN)
6	PHAS	2	Phase of Work
7	CATW	1	Category of Work
8	FOW1	10	Feature of Work (used up to 10 characters in length)
9	FOW2	10	Feature of Work (used up to 20 characters in length)
10	FOW3	10	Feature of Work (used up to 30 characters in length)

## 3.5. SUBMISSION REQUIREMENTS

Submit the following items for the Preliminary Schedule, Initial Schedule, and every Periodic Schedule Update throughout the life of the project:

### 3.5.1. Data CD's



Provide two sets of data CD's containing the project schedule in the backup format. Each CD shall also contain all previous update backup files. File medium shall be CD. Label each CD, indicating the type of schedule (Preliminary, Initial, Update), full contract number, Data Date and file names. Each schedule shall have a unique file name as determined by the Contractor.

### 3.5.2. Narrative Report

Provide a Narrative Report with the Preliminary, Initial, and each Periodic Update of the project schedule, as the basis of the progress payment request. The Narrative Report shall include: a description of activities along the 2 most critical paths where the total float is less than or equal to 20 work days, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. The narrative report is expected to communicate to the Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through its analysis. Identify and explain why any activities that, based their calculated late dates, should have either started or finished during the update period but did not.

### 3.5.3. Approved Changes Verification

Include only those project schedule changes in the schedule submission that have been previously approved by the Contracting Officer. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

### 3.5.4. Schedule Reports

The format, filtering, organizing and sorting for each schedule report shall be as directed by the Contracting Officer. Typically reports shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date Total Float, Actual Start Date, Actual Finish Date, and Percent Complete. The following lists typical reports that will be requested. One or all of these reports may be requested for each schedule submission.

#### 3.5.4.1. Activity Report

A list of all activities sorted according to activity number.

#### 3.5.4.2. Logic Report

A list of detailed predecessor and successor activities for every activity in ascending order sorted by activity number.

#### 3.5.4.3. Total Float Report

A list of all incomplete activities sorted in ascending order of total float. List activities which have the same amount of total float in ascending order of Early Start Dates. Do not show completed activities on this report.

#### 3.5.4.4. Earnings Report by CLIN

A compilation of the Contractor's Total Earnings on the project from the NTP to the data date. This report shall reflect the earnings of specific activities based on the agreements made in the schedule update meeting defined herein. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining progress payments. Group activities by CLIN Item number and sort by activity number. This report shall: sum all activities coded to a particular CLIN and provide a CLIN Item percent earned value; and complete and sum CLIN items to provide a total project percent complete. The printed report shall contain, for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Quantity to Date, Percent Complete (based on cost), and Earnings to Date.

### 3.5.5. Network Diagram

The network diagram is required for the Preliminary, Initial and Periodic Updates. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished.

The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

#### 3.5.5.1. Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. Show the activity number, description, duration, and estimated earned value on the diagram.

#### 3.5.5.2. Project Milestone Dates

Show dates on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

#### 3.5.5.3. Critical Path

Clearly show the critical path.

#### 3.5.5.4. Banding

Organize activities as directed to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

#### 3.5.5.5. S-Curves

Earnings curves showing projected early and late earnings and earnings to date.

### 3.6. PERIODIC SCHEDULE UPDATE MEETINGS

Conduct periodic schedule update meetings for the purposes of reviewing the Contractor's proposed out of sequence corrections, determining causes for delay, correcting logic, maintaining schedule accuracy and determining earned value. Meetings shall occur at least monthly within five days of the proposed schedule data date and after the Contractor has updated the schedule with Government concurrence respecting actual start dates, actual finish dates, remaining durations and percent complete for each activity it intend to status. Match the actual start and finish dates with the dates exported, as described in paragraph 3.3.5. Provide a computer with the scheduling software loaded and a projector during the meeting which allows all meeting participants to view the proposed schedule update during the meeting. The meeting and resultant approvable schedule update shall be a condition precedent to a formal submission of the update as described in SUBMISSION REQUIREMENTS and to the submission of an invoice for payment. The meeting will be a working interactive exchange which will allow the Government and the Contractor the opportunity review the updated schedule on a real time and interactive basis. The Contractor's authorized scheduling representative will organize, sort, filter and schedule the update as requested by the Government. The meeting will last no longer than 8 hours. A rough draft of the proposed activity logic corrections and narrative report shall be provided to the Government 48 hours in advance of the meeting. The Contractor's Project Manager and Authorized Scheduler shall attend the meeting with the Authorized Representative of the Contracting Officer.

#### 3.6.1. Update Submission Following Progress Meeting

Submit a complete update of the project schedule containing all approved progress, revisions, and adjustments, pursuant to paragraph SUBMISSION REQUIREMENTS not later than 4 working days after the periodic schedule update meeting, reflecting only those changes made during the previous update meeting.

#### 3.6.2. Activity Statusing

Statusing information, including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD) and Percent Complete shall be subject to the approval of the Government prior to the meeting. As a minimum, address the following items on an activity by activity basis during each progress meeting:

##### 3.6.2.1. Actual Start and Finish Dates

Accurately status the AS and/or AF dates for each activity currently in-progress or completed since the last update. The Government may allow an AF date to be assigned with the percent complete less than 100% to account for the value of work remaining but not restraining successor activities. Only assign AS dates when actual progress occurs on an activity.

#### 3.6.2.2. Remaining Duration

Update the estimated RD for all incomplete activities independent of Percent Complete. Remaining durations may exceed the activity OD or may exceed the activity's prior update RD if the Government considers the current OD or RD to be understated based on current progress, insufficient work crews actually manning the job, unrealistic OD or deficiencies that must be corrected that restrain successor activities.

#### 3.6.2.3. Percent Complete

Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be statused 100 percent complete. To allow for proper schedule management, cost load the correction of punch list from Government pre-final inspection activity(ies) not less than 1% of the total contract value, which activity(ies) may be statused 100 percent complete upon completion and correction of all punch list work identified during Government pre-final inspection(s).

#### 3.6.2.4. Logic Changes

Specifically identify and discuss all logic changes pertaining to NTP on change orders, change orders to be incorporated into the schedule, contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, and other changes that have been made pursuant to contract provisions. The Government will only approve logic revisions for the purpose of keeping the schedule valid in terms of its usefulness in calculating a realistic completion date, correcting erroneous logic ties, and accurately sequencing the work.

#### 3.6.2.5. Other Changes

Other changes required due to delays in completion of any activity or group of activities include: 1) delays beyond the Contractor's control, such as strikes and unusual weather. 2) delays encountered due to submittals, Government Activities, deliveries or work stoppages which make re-planning the work necessary. 3) Changes required to correct a schedule that does not represent the actual or planned prosecution and progress of the work.

### 3.7. REQUESTS FOR TIME EXTENSIONS

In the event the Contractor believes it is entitled to an extension of the contract performance period, completion date, or any interim milestone date, furnish the following for a determination by the Contracting Officer: justification, project schedule data, and supporting evidence as the Contracting Officer may deem necessary. Submission of proof of excusable delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is a condition precedent to any approvals by the Government. In response to each Request For Proposal issued by the Government, the Contractor shall submit a schedule impact analysis demonstrating whether or not the change contemplated by the Government impacts the critical path.

#### 3.7.1. Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with its request. The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information.

Actual delays that are found to be caused by the Contractor's own actions, which result in a calculated schedule delay, will not be a cause for an extension to the performance period, completion date, or any interim milestone date.

#### 3.7.2. Submission Requirements

Submit a justification for each request for a change in the contract completion date of less than 2 weeks based upon the most recent schedule update at the time of the NTP or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

3.7.2.1. A list of affected activities, with their associated project schedule activity number.

3.7.2.2. A brief explanation of the causes of the change

3.7.2.3. An analysis of the overall impact of the changes proposed.

3.7.2.4. A sub-network of the affected area

Identify activities impacted in each justification for change by a unique activity code contained in the required data file.

### 3.7.3. Additional Submission Requirements

The Contracting Officer may request an interim update with revised activities for any requested time extension of over 2 weeks. Provide this disk within 4 days of the Contracting Officer's request.

### 3.7.4. If Progress Falls Behind the Approved Project Schedule

3.7.4.1. Should progress fall behind the approved schedule (more than 20 work days of negative float) due to Contractor generated problems, promptly provide a supplemental recovery or completion schedule that illustrates its efforts to regain time to assure a completion by the required contract completion date.

3.7.4.2. The supplemental recovery or completion schedule will not replace the original, approved schedule as the official contract schedule. Continue to update the original, approved schedule on at least a monthly basis. In addition, the Contractor and the Contracting Officer will monitor the supplemental recovery or completion schedule on at least a bi-weekly basis to determine its effect on regaining the rate of progress to assure project completion by the contractually required completion date.

3.7.4.3. Do not artificially improve progress by simply revising the schedule logic, modifying or adding constraints, or shortening future work activity durations. Resource and manpower load the supplemental recovery schedule or completion schedule with crew size and productivity for each remaining activity, indicating overtime, weekend work, and/or double shifts needed to regain the schedule, in accordance with FAR 52.236.15, without additional cost to the Government. Indicate assumptions made and the basis for any logic, constraint, or duration changes used in the creation of the supplemental recovery or completion schedule in a narrative submitted for the Contracting Officer's approval. Any additional resources or manpower must be evident at the work site. Do not modify the official contract schedule to include these assumptions.

3.7.4.4. Failure to perform work and maintain progress in accordance with the supplemental recovery or completion schedule may result in an interim and final unsatisfactory performance rating and/or may result in corrective action by the Contracting Officer in accordance with FAR 52.236-15.

### 3.8. DIRECTED CHANGES

If the NTP is issued for changes prior to settlement of price and/or time, submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The Contracting Officer will approve proposed revisions to the schedule prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor with suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until revisions are submitted and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the

Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

### 3.9. WEEKLY PROGRESS MEETINGS

3.9.1. The Government and the Contractor shall meet weekly (or as otherwise mutually agreed to) between the meetings described in paragraph PERIODIC SCHEDULE UPDATE MEETINGS for the purpose of jointly reviewing the actual progress of the project as compared to the as planned progress and to review planned activities for the upcoming two weeks. The then current and approved schedule update shall be used for the purposes of this meeting and for the production and review of reports. The Contractor's Project Manager and the Authorized Representative of the Contracting Officer shall attend. The weekly progress meeting will address the status of RFI's, RFP's and Submittals.

3.9.2. Provide a bar chart produced by the scheduling software, organized by Total Float and Sorted by Early Start Date, and a two week "look-ahead" schedule by filtering all schedule activities to show only current ongoing activities and activities schedule to start during the upcoming two weeks, organized by Work Area Code (AREA) and sorted by Early Start Date.

3.9.3. The Government and the Contractor shall jointly review the reports. If it appears that activities on the longest path(s) which are currently driving the calculated completion date (driving activities), are not progressing satisfactorily and therefore could jeopardize timely project completion, corrective action must be taken immediately. Corrective action includes but is not limited to: increasing the number of work crews; increasing the number of work shifts; increasing the number of hours worked per shift; and determining if Government responsibility coded activities require Government corrective action.

### 3.10. OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

### 3.11. TRANSFER OF SCHEDULE DATA INTO RMS/QCS

The Contractor shall download and upload the schedule data into the Resident Management System (RMS) prior to RMS databases being transferred to the Government and is considered to be additional supporting data in a form and detail required by the Contracting Officer pursuant to FAR 52.232-5 - Payments under Fixed-Price Construction Contracts. The receipt of a proper payment request pursuant to FAR 52.232-27 - Prompt Payment for Construction Contracts is contingent upon the Government receiving both acceptable and approvable hard copies and electronic export from QCS of the application for progress payment.

End of Section 01 32 01.00 10

**SECTION 01 33 00**  
**SUBMITTAL PROCEDURES**

**1.0 GENERAL**

- 1.1. DEFINITIONS
- 1.2. NOT USED
- 1.3. SUBMITTAL CLASSIFICATION
- 1.4. APPROVED OR CONCURRED WITH SUBMITTALS
- 1.5. DISAPPROVED SUBMITTALS
- 1.6. WITHHOLDING OF PAYMENT
- 1.7. GENERAL
- 1.8. SUBMITTAL REGISTER
- 1.9. SCHEDULING
- 1.10. TRANSMITTAL FORM (ENG FORM 4025)
- 1.11. SUBMITTAL PROCEDURES
- 1.12. CONTROL OF SUBMITTALS
- 1.13. GOVERNMENT APPROVED SUBMITTALS
- 1.14. INFORMATION ONLY SUBMITTALS
- 1.15. STAMPS

## 1.0 GENERAL

### 1.1. DEFINITIONS

#### 1.1.1. Submittal

Contract Clauses "FAR 52.236-5, Material and Workmanship," paragraph (b) and "FAR 52.236-21, Specifications and Drawings for Construction," paragraphs (d), (e), and (f) apply to all "submittals."

#### 1.1.2. Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by SD numbers and titles as follows.

##### SD-01 Preconstruction Submittals

- Certificates of insurance.
- Surety bonds.
- List of proposed subcontractors.
- List of proposed products.
- Construction Progress Schedule.
- Submittal register.
- Schedule of prices.
- Accident Prevention Plan.
- Work plan.
- Quality control plan.
- Environmental protection plan.

##### SD-02 Shop Drawings

- Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.
- Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.
- Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

##### SD-03 Product Data

- Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials or equipment for some portion of the work.
- Samples of warranty language when the contract requires extended product warranties.

##### SD-04 Samples

- Physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.
- Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.
- Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies that are to be incorporated into the project and those which will be removed at conclusion of the work.

##### SD-05 Design Data

- Calculations, mix designs, analyses or other data pertaining to a part of work.
- Design submittals, design substantiation submittals and extensions of design submittals.

##### SD-06 Test Reports

- Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must

have been within three years of date of contract award for the project.)

- Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.
- Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.
- Investigation reports.
- Daily checklists.
- Final acceptance test and operational test procedure.

#### SD-07 Certificates

- Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.
- Document required of Contractor, or of a supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.
- Confined space entry permits.
- Text of posted operating instructions.

#### SD-08 Manufacturer's Instructions

- Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions.

#### SD-09 Manufacturer's Field Reports

- Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- Factory test reports.

#### SD-10 Operation and Maintenance Data

- Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

#### SD-11 Closeout Submittals

- Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

##### 1.1.3. Approving Authority

Office authorized to approve submittal.

##### 1.1.4. Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

##### 1.2. NOT USED

##### 1.3. SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

##### 1.3.1. Designer of Record Approved (DA)



1.3.1.1. Designer of Record (DOR) approval is required for all extensions of design, critical materials, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction", they are considered to be "shop drawings". Provide the Government the number of copies designated hereinafter of all DOR approved submittals, after the DOR has taken appropriate action. The DOR shall ensure that submittals conform to the Solicitation, the Accepted Proposal and the completed design, however see below for those submittals proposing a deviation to the contract or a substitution of a material, system, or piece of equipment that was identified by manufacturer, brand name or model description in the accepted contract proposal.

1.3.1.2. The DOR shall ensure that the submittals comply with all applicable Buy American Act and Trade Agreement Act clauses in the contract. The DOR may confer with the Contracting Officer's Representative for advice and interpretation of those clauses, as necessary.

1.3.1.3. The Government may, but is not required to, review any or all DOR approved submittals for conformance to the solicitation, accepted proposal and the completed design. Except for submittals designated as deviating from the Solicitation, the Accepted Proposal or completed design, the Contractor may proceed with acquisition and installation upon DOR approval. Government Approved (GA)

#### 1.3.2. Government Approved (GA)

Government approval is required for any item specifically designated as requiring Government approval in the Solicitation, for internal and external color finish selections and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

#### 1.3.3. Government Conformance Review of Design (CR)

The Government will review all intermediate and final design submittals for conformance with the technical requirements of the solicitation. Section 01 33 16 **DESIGN AFTER AWARD** covers the design submittal and review process in detail. Review will be only for conformance with the applicable codes, standards and contract requirements. Design data includes the design documents described in Section 01 33 16 **DESIGN AFTER AWARD**. Generally, design submittals should be identified as SD-05 Design Data submittals.

#### 1.3.4. Designer of Record Approved/Government Conformance Review (DA/CR)

1.3.4.1. Deviations to the Accepted Design. Designer of Record approval and the Government's concurrence are required for any proposed deviation from the accepted design which still complies with the contract (the Solicitation and Accepted Proposal) before the Contractor is authorized to proceed with material acquisition or installation. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction", they are considered to be "shop drawings." If necessary to facilitate the project schedule, the Contractor and the DOR may discuss a submittal proposing a deviation with the Contracting Officer's Representative prior to officially submitting it to the Government. However, the Government reserves the right to review the submittal before providing an opinion, if it deems it necessary. In any case, the Government will not formally agree to or provide a preliminary opinion on any deviation without the DOR's approval or recommended approval. The Government reserves the right to non-concur with any deviation from the design, which may impact furniture, furnishings, equipment selections or operations decisions that were made, based on the reviewed and concurred design.

1.3.4.2. Substitutions. Unless prohibited or provided for otherwise elsewhere in the Contract, where the accepted contract proposal named products, systems, materials or equipment by manufacturer, brand name and/or by model number or other specific identification, and the Contractor desires to substitute manufacturer or model after award, submit a requested substitution for Government concurrence. Include substantiation, identifying information and the DOR's approval, as meeting the contract requirements and that it is equal in function, performance, quality and salient features to that in the accepted contract proposal.

#### 1.3.5. Designer of Record Approved/Government Approved (DA/GA)

Any proposed deviation to the solicitation and/or the accepted proposal constitutes a change to the contract. In addition to the above stated requirements for proposed deviations to the accepted design, both Designer of Record and Government Approval and, where applicable, a contract modification are required before the Contractor is

authorized to proceed with material acquisition or installation for any proposed deviation to the contract. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction", they are considered to be "shop drawings". The Government reserves the right to accept or reject any such proposed deviation at its discretion.

#### 1.3.6. Information Only

All submittals not requiring Designer of Record or Government approval will be for information only. Provide the Government "For Information Only" copies of all submittals not requiring Government approval or concurrence, after the Designer of Record has taken the appropriate action.

#### 1.4. APPROVED OR CONCURRED WITH SUBMITTALS

Do not construe the Contracting Officer's approval of or concurrence with submittals as a complete check, but only that design, general method of construction, materials, detailing and other information appear to meet the Solicitation and Accepted Proposal. Approval or concurrence will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for design, dimensions, all design extensions, such as the design of adequate connections and details, etc., and the satisfactory construction of all work. The Government won't consider re-submittals for the purpose of substituting previously approved materials or equipment unless accompanied by an explanation of why a substitution is necessary.

#### 1.5. DISAPPROVED SUBMITTALS

Make all corrections required by the Contracting Officer, obtain the Designer of Record's approval when applicable, and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. Resubmit any "information only" submittal found to contain errors or unapproved deviations from the Solicitation or Accepted Proposal as one requiring "approval" action, requiring both Designer of Record and Government approval. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, provide prompt notice in accordance with the Contract Clause "Changes" to the Contracting Officer.

#### 1.6. WITHHOLDING OF PAYMENT

No payment for materials incorporated in the work will be made if all required Designer of Record or required Government approvals have not been obtained. No payment will be made for any materials incorporated into the work for any conformance review submittals or information only submittals found to contain errors or deviations from the Solicitation or Accepted Proposal.

#### 1.7. GENERAL

Make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, the Contractor's Quality Control (CQC) System Manager and the Designer of Record, if applicable, shall check, approve, sign, and stamp all items, indicating action taken. Clearly identify proposed deviations from the contract requirements. Include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Schedule and make submittals requiring Government approval prior to the acquisition of the material or equipment covered thereby. Pick up and dispose of samples remaining upon completion of the work in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

#### 1.8. SUBMITTAL REGISTER (GA)

Develop a complete list of submittals, including each separate design package submittal. Submit the initial submittal register within 15 days after Notice to Proceed, including, as a minimum, the design packages and other initial submittals required elsewhere in the contract. The Designer of Record shall identify required submittals in the

specifications, and use the list to prepare the Submittal Register, utilizing the government-provided software, QCS (see Section 01 45 01.10), to create the ENG Form 4288. Appendix R is a preliminary submittal register input form for use with the Quality Management System and the Resident Office Management System (QCS and RMS). The Government will provide the Contractor the actual Excel Spreadsheet version of this sample input form after award to modify and to use for input into QCS. The Excel Spreadsheet is not totally inputable into QCS, so additional keystroke input will be necessary. The sample input form is not all-inclusive. In addition, additional submittals may be required by other parts of the contract. After award, the parties will meet to discuss contract specific (or task order specific for a task order contract) distribution for the submittals all-inclusive and additional submittals may be required by other parts of the contract. Develop and complete the submittal register as the design is completed. Submit it to the Contracting Officer with the un-reviewed final design package submission or as soon as the design specifications are completed, if before the final design submission. When applicable, if the Contractor elects to fast track design and construction, using multiple design package submissions, update the submittal register to reflect the submittals associated with each design submission, clearly denoting all revisions to the previous submission. The submittal register serves as a scheduling document for submittals and for control of submittal actions throughout the contract period. Coordinate the submit dates and need dates used in the submittal register with dates in the Contractor prepared progress schedule. Submit monthly updates to the submittal register showing the Contractor action codes and actual dates with Government action codes and actual dates or until all submittals have been satisfactorily completed. Revise and submit the submittal register when revising the progress schedule.

#### 1.9. SCHEDULING

Schedule submittals covering component items forming a system or items that are interrelated to be coordinated and submitted concurrently. Schedule certifications to be submitted with the pertinent drawings. Allow adequate time (a minimum of 15 calendar days exclusive of mailing time) and show on the register for those items requiring Government approval or concurrence. No delay damages or time extensions will be allowed for time lost in late submittals by the Contractor.

#### 1.10. TRANSMITTAL FORM (ENG FORM 4025)

Use the transmittal form (ENG Form 4025) for submitting submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor or are included in the QCS software if the Contractor is required to use QCS for this contract. Use a separate transmittal form for each specification section. Complete this form by filling out all the heading blank spaces and identify each item submitted. Exercise special care to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

#### 1.11. SUBMITTAL PROCEDURES

Make submittals as follows:

##### 1.11.1. Procedures

The Government will further discuss detailed submittal procedures with the Contractor at the Post-Award Conference.

##### 1.11.2. Deviations

For submittals which include proposed deviations requested by the Contractor, check the column "variation" of ENG Form 4025. Set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

#### 1.12. CONTROL OF SUBMITTALS

Carefully control his procurement operations to ensure that each individual submittal is made on or before the scheduled submittal date shown on the approved "Submittal Register."

#### 1.13. GOVERNMENT APPROVED OR CONCURRED WITH SUBMITTALS

Upon completion of review of submittals requiring Government approval or concurrence, the Government will stamp and date the submittals as approved or concurred.. The Government will retain two (2) copies of the submittal and return one (1) copy(ies) of the submittal.

#### 1.14. INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe. The Government will retain two (2) copies of information only submittals.

#### 1.15. STAMPS

Use stamps similar to the following on the submittal data to certify that the submittal meets contract requirements:

CONTRACTOR

(FIRM NAME)

Approved

Approved with corrections as noted on submittal data and/or attached  
sheet(s)

Signature:

Title:

Date:

**For design-build construction, both the Contractor Quality Control System Manager and the Designer of Record shall stamp and sign to certify that the submittal meets contract requirements.**

**SECTION 01 33 16  
DESIGN AFTER AWARD**

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**ATTACHMENT E LEED SUBMITTALS**

**ATTACHMENT F BUILDING INFORMATION MODELING REQUIREMENTS**

**ATTACHMENT G DESIGN SUBMITTAL DIRECTORY AND SUBDIRECTORY FILE ARRANGEMENT**

## **1.0 GENERAL INFORMATION**

### **1.1. INTRODUCTION**

1.1.1. The information contained in this section applies to the design required after award. After award, the Contractor will develop the accepted proposal into the completed design, as described herein.

1.1.2. The Contractor may elect to fast track the design and construction that is, proceed with construction of parts of the sitework and facilities prior to completion of the overall design. To facilitate fast tracking, the Contractor may elect to divide the design into no more than ten (10) design packages per major facility type and no more than three (3) design packages for site and associated work. Designate how it will package the design, consistent with its overall plan for permitting (where applicable) and construction of the project. See Sections 01 33 00 SUBMITTAL PROCEDURES and 01 32 01.00 10 PROJECT SCHEDULE for requirements for identifying and scheduling the design packaging plan in the submittal register and project schedule. See also Sections 01 10 00 STATEMENT OF WORK and 01 57 20.00 10 ENVIRONMENTAL PROTECTION for any specified permit requirements. If early procurement of long-lead item construction materials or installed equipment, prior to completion of the associated design package, is necessary to facilitate the project schedule, also identify those long-lead items and how it will assure design integrity of the associated design package to meet the contract requirements (The Contract consists of the Solicitation requirements and the accepted proposal). Once the Government is satisfied that the long-lead items meet the contract requirements, the Contracting Officer will allow the Contractor to procure the items at its own risk.

1.1.3. The Contractor may proceed with the construction work included in a separate design package after the Government has reviewed the final (100%) design submission for that package, review comments have been addressed and resolved to the Government's satisfaction and the Contracting Officer (or the Administrative Contracting Officer) has agreed that the design package may be released for construction.

1.1.4. **INTEGRATED DESIGN.** To the maximum extent permitted for this project, use a collaborative, integrated design process for all stages of project delivery with comprehensive performance goals for siting, energy, water, materials and indoor environmental quality and ensures incorporation of these goals. Consider all stages of the building lifecycle, including deconstruction.

### **1.2. DESIGNER OF RECORD**

Identify, for approval, the Designer of Record ("DOR") that will be responsible for each area of design. One DOR may be responsible for more than one area. Listed, Professional Registered, DOR(s) shall account for all areas of design disciplines shall be accounted for by a listed. The DOR's shall stamp, sign, and date each design drawing and other design deliverables under their responsible discipline at each design submittal stage (see contract clause Registration of Designers). If the deliverables are not ready for release for construction, identify them as "preliminary" or "not for release for construction" or by using some other appropriate designation. The DOR(s) shall also be responsible for maintaining the integrity of the design and for compliance with the contract requirements through construction and documentation of the as-built condition by coordination, review and approval of extensions of design, material, equipment and other construction submittals, review and approval or disapproval of requested deviations to the accepted design or to the contract, coordination with the Government of the above activities, and by performing other typical professional designer responsibilities.

## **2.0 PRODUCTS (Not Applicable)**

## **3.0 EXECUTION**

### **3.1. PRE-WORK ACTIVITIES & CONFERENCES**

#### **3.1.1. Design Quality Control Plan**

Submit for Government acceptance, a Design Quality Control Plan in accordance with Section 01 45 04.00 10 CONTRACTOR QUALITY CONTROL before design may proceed.

#### **3.1.2. Post Award Conference**



3.1.2.1. The government will conduct a post award contract administration conference at the project site, as soon as possible after contract award. This will be coordinated with issuance of the contract notice to proceed (NTP). The Contractor and major sub-contractor representatives shall participate. All designers need not attend this first meeting. Government representatives will include COE project delivery team members, facility users, facility command representatives, and installation representatives. The Government will provide an agenda, meeting goals, meeting place, and meeting time to participants prior to the meeting.

3.1.2.2. The post award conference shall include determination and introduction of contact persons, their authorities, contract administration requirements, discussion of expected project progress processes, and coordination of subsequent meetings for quality control (see Section 01 45 04.00 10 CONTRACTOR QUALITY CONTROL), Partnering (see below and SCR: Partnering), and the initial design conference (see below).

3.1.2.3. The government will introduce COE project delivery team members, facility users, facility command representatives, and installation representatives. The DB Contractor shall introduce major subcontractors, and other needed staff. Expectations and duties of each person shall be defined for all participants. A meeting roster shall be developed and distributed by the government with complete contact information including name, office, project role, phone, mailing and physical address, and email address.

### 3.1.3. Partnering & Project Progress Processes

3.1.3.1. The initial Partnering conference may be scheduled and conducted at any time with or following the post award conference. The Government proposes to form a partnership with the DB Contractor to develop a cohesive building team. This partnership will involve the COE project delivery team members, facility users, facility command representatives, installation representatives, Designers of Record, major subcontractors, contractor quality control staff, and contractor construction management staff. This partnership will strive to develop a cooperative management team drawing on the strengths of each team member in an effort to achieve a quality project within budget and on schedule. This partnership will be bilateral in membership and participation will be totally voluntary. All costs, excluding labor and travel expenses, shall be shared equally between the Government and the Contractor. The Contractor and Government shall be responsible for their own labor and travel costs. Normally, partnering meetings will be held at or in the vicinity of the project installation.

3.1.3.2. As part of the partnering process, the Government and Contractor shall develop, establish, and agree to comprehensive design development processes including conduct of conferences, expectations of design development at conferences, fast-tracking, design acceptance, Structural Interior Design (SID)/ Furniture, Fixtures & Equipment (FF&E) design approval, project closeout, etc. The government will explain contract requirements and the DB Contractor shall review their proposed project schedule and suggest ways to streamline processes.

### 3.1.4. Initial Design Conference

The initial design conference may be scheduled and conducted at the project installation any time after the post award conference, although it is recommended that the partnering process be initiated with or before the initial design conference. Any design work conducted after award and prior to this conference should be limited to site and is discouraged for other items. All Designers of Record shall participate in the conference. The purpose of the meeting is to introduce everyone and to make sure any needs the contractor has are assigned and due dates established as well as who will get the information. See also Attachment F, BUILDING INFORMATION MODELING REQUIREMENTS for discussion concerning the BIM Implementation Plan demonstration at this meeting. The DB Contractor shall conduct the initial design conference.

### 3.1.5. Pre-Construction Conference

Before starting construction activities, the Contractor and Government will jointly conduct a pre-construction administrative conference to discuss any outstanding requirements and to review local installation requirements for start of construction. It is possible there will be multiple Pre-Construction Conferences based on the content of the design packages selected by the Contractor. The Government will provide minutes of this meeting to all participants.

## 3.2. STAGES OF DESIGN SUBMITTALS AND OVER THE SHOULDER PROGRESS REVIEWS

The stages of design submittals described below define Government expectations with respect to process and content. The Contractor shall determine how to best plan and execute the design and review process for this project, within the parameters listed below. As a minimum, the Government expects to see at least one interim design submittal, at least one final design submittal before construction of a design package may proceed and at least one Design Complete submittal that documents the accepted design. The Contractor may sub-divide the design into separate packages for each stage of design and may proceed with construction of a package after the Government accepts the final design for that package. See discussion on waivers to submission of one or more intermediate design packages where the parties partner during the design process. See also Attachment F, BUILDING INFORMATION MODELING REQUIREMENTS for discussion concerning BIM and the various stages of design submittals and over-the-shoulder progress reviews.

### 3.2.1. Site/Utilities

To facilitate fast-track design-construction activities the contractor may submit a final (100%) site and utility design as the first design submittal or it may elect to submit interim and final site and utility design submittals as explained below. Following review, resolution, and incorporation of all Government comments, and submittal of a satisfactory set of site/utility design documents, after completing all other pre-construction requirements in this contract and after the pre-construction meeting, the Government will allow the Contractor to proceed with site development activities, including demolition where applicable, within the parameters set forth in the accepted design submittal. For the first site and utility design submission, whether an interim or final, the submittal review, comment, and resolution times from this specification apply, except that the Contractor shall allow the Government a 14 calendar day review period, exclusive of mailing time. No on-site construction activities shall begin prior to written Government clearance to proceed.

### 3.2.2. Interim Design Submittals

The Contractor may submit either a single interim design for review, representing a complete package with all design disciplines, or split the interim design into smaller, individual design packages as it deems necessary for fast-track construction purposes. As required in Section 01 32 01.00 10 PROJECT SCHEDULE, the Contractor shall schedule its design and construction packaging plan to meet the contract completion period. This submission is the Government's primary opportunity to review the design for conformance to the solicitation and to the accepted contract proposal and to the Building Codes at a point where required revisions may be still made, while minimizing lost design effort to keep the design on track with the contract requirements. The requirements for the interim design review submittals and review conferences are described hereinafter. This is not necessarily a hold point for the design process; the Contractor may designate the interim design submittal(s) as a snapshot and proceed with design development at its own risk. See below for a waiver, where the parties establish an effective over-the-shoulder progress review procedure through the partnering process that would eliminate the need for or expedite a formal intermediate design review on one or more individual design packages.

### 3.2.3. Over-the-Shoulder Progress Reviews

To facilitate a streamlined design-build process, the Government and the Contractor may agree to one-on-one reviewer or small group reviews, electronically, on-line (if available within the Contractor's standard design practices) or at the Contractor's design offices or other agreed location, when practicable to the parties. The Government and Contractor will coordinate such reviews to minimize or eliminate disruptions to the design process. Any data required for these reviews shall normally be provided in electronic format, rather than in hard copy. If the Government and Contractor establish and implement an effective, mutually agreeable partnering procedure for regular (e.g., weekly) over-the shoulder review procedures that allow the Government reviewers the opportunity to keep fully informed of the progress, contents, design intent, design documentation, etc. of the design package, the Government will agree to waive or to expedite the formal intermediate design review period for that package. The Contractor shall still be required to submit the required intermediate design documentation, however the parties may agree to how that material will be provided, in lieu of a formal consolidated submission of the package. It should be noted that Government funding is extremely limited for non-local travel by design reviewers, so the maximum use of virtual teaming methods must be used. Some possible examples include electronic file sharing, interactive software with on-line or telephonic conferencing, televideo conferencing, etc. The Government must still perform its Code and Contract conformance reviews, so the Contractor is encouraged to partner with the reviewers to find ways to facilitate this process and to facilitate meeting or bettering the design-build schedule. The Contractor shall maintain a fully functional configuration management system as described herein to track design revisions, regardless of whether or not there is a need for a formal intermediate design review. The formal intermediate

review procedures shall form the contractual basis for the official schedule, in the event that the partnering process determines that the formal intermediate review process to be best suited for efficient project execution. However, the Government pledges to support and promote the partnering process to work with the Contractor to find ways to better the design schedule.

#### 3.2.4. Final Design Submissions

This submittal is required for each design package prior to Government acceptance of that design package for construction. The requirements for the final design submittal review conferences and the Government's acceptance for start of construction are described herein after.

#### 3.2.5. Design Complete Submittals

After the final design submission and review conference for a design package, revise the design package to incorporate the comments generated and resolved in the final review conferences, perform and document a back-check review and submit the final, design complete documents, which shall represent released for construction documents. The requirements for the design complete submittals are described hereinafter.

#### 3.2.6. Holiday Periods for Government Review or Actions

Do not schedule meetings, Government reviews or responses during the last two weeks of December or other designated Government Holidays (including Friday after Thanksgiving). Exclude such dates and periods from any durations specified herein for Government actions.

#### 3.2.7. Late Submittals and Reviews

If the Contractor cannot meet its scheduled submittal date for a design package, it must revise the proposed submittal date and notify the government in writing, at least one (1) week prior to the submittal, in order to accommodate the Government reviewers' other scheduled activities. If a design submittal is over one (1) day late in accordance with the latest revised design schedule, or if notification of a proposed design schedule change is less than seven (7) days from the anticipated design submission receipt date, the Government review period may be extended up to seven (7) days due to reviewers' schedule conflicts. If the Government is late in meeting its review commitment and the delay increases the Contractor's cost or delays completion of the project, the Suspension of Work and Defaults clauses provide the respective remedy or relief for the delay.

### 3.3. DESIGN CONFIGURATION MANAGEMENT

#### 3.3.1. Procedures

Develop and maintain effective, acceptable design configuration management (DCM) procedures to control and track all revisions to the design documents after the Interim Design Submission through submission of the As-Built documents. During the design process, this will facilitate and help streamline the design and review schedule. After the final design is accepted, this process provides control of and documents revisions to the accepted design (See Special Contract Requirement: Deviating From the Accepted Design). The system shall include appropriate authorities and concurrences to authorize revisions, including documentation as to why the revision must be made. The DCM data shall be available to the Government reviewers at all times. The Contractor may use its own internal system with interactive Government concurrences, where necessary or may use the Government's "DrChecks Design Review and Checking System" (see below and Attachment C).

#### 3.3.2. Tracking Design Review Comments

Although the Contractor may use its own internal system for overall design configuration management, the Government and the Contractor shall use the DrChecks Design Review and Checking System to initiate, respond to, resolve and track Government design compliance review comments. This system may be useful for other data which needs to be interactive or otherwise available for shared use and retrieval. See Attachment C for details on how to establish an account and set-up the DrChecks system for use on the project.

#### 3.3.3. Design and Code Checklists

Develop and complete various discipline-specific checklists to be used during the design and quality control of each submittal. Submit these completed checklists with each design submittal, as applicable, as part of the project documentation. See Section 01 45 04.00 10 Contractor Quality Control, Attachment D for a Sample Fire Protection and Life Safety Code review checklist and Attachment E for LEED SUBMITTALS.

### 3.4. INTERIM DESIGN REVIEWS AND CONFERENCES

#### 3.4.1. General

At least one interim design submittal, review and review conference is required for each design package (except that, per paragraph 3.2.1, the Contractor may skip the interim design submission and proceed directly to final design on the sitework and utilities package). The DB Contractor may include additional interim design conferences or over-the-shoulder reviews, as needed, to assure continued government concurrence with the design work. Include the interim submittal review periods and conferences in the project schedule and indicate what part of the design work is at what percentage of completion. The required interim design conferences shall be held when interim design requirements are reached as described below. See also Paragraph: **Over-the-Shoulder Progress Reviews** for a waiver to the formal interim design review.

#### 3.4.2. Procedures

After receipt of an Interim Design submission, allow the Government fourteen (14) calendar days after receipt of the submission to review and comment on the interim design submittal. For smaller design packages, especially those that involve only one or a few separate design disciplines, the parties may agree on a shorter review period or alternative review methods (e.g., over-the-shoulder or electronic file sharing), through the partnering process. For each interim design review submittal, the COR will furnish, to the Contractor, a single consolidated, validated listing of all comments from the various design sections and from other concerned agencies involved in the review process using the DrChecks Design Review and Checking System. The review will be for conformance with the technical requirements of the solicitation and the Contractor's RFP proposal. If the Contractor disagrees technically with any comment or comments and does not intend to comply with the comment, he/she must clearly outline, with ample justification, the reasons for noncompliance within five (5) days after receipt of these comments in order that the comment can be resolved. Furnish disposition of all comments, in writing, through DrChecks. The Contractor is cautioned that if it believes the action required by any comment exceeds the requirements of this contract, that it should take no action and notify the COR in writing immediately. The Interim Review conference will be held for each design submittal at the installation. Bring the personnel that developed the design submittal to the review conference. The conference will take place the week after the receipt of the comments by the Contractor. For smaller fast-track packages that involve only a few reviewers, the parties may agree to alternative conferencing methods, such as teleconferencing, or televideo, where available, as determined through Partnering.

#### 3.4.3. Conference Documentation

3.4.3.1. In order to facilitate and accelerate the Government code and contract conformance reviews, identify, track resolution of and maintain all comments and action items generated during the design process and make this available to the designers and reviewers prior to the Interim and subsequent design reviews.

3.4.3.2. The DB Contractor shall prepare meeting minutes and enter final resolution of all comments into DrChecks. Copies of comments, annotated with comment action agreed on, will be made available to all parties before the conference adjourns. Unresolved problems will be resolved by immediate follow-on action at the end of conferences. Incorporate valid comments. The Government reserves the right to reject design document submittals if comments are significant. Participants shall determine if any comments are critical enough to require further design development prior to government concurrence. Participants shall also determine how to proceed in order to obtain government concurrence with the design work presented.

### 3.5. INTERIM DESIGN REQUIREMENTS

Interim design deliverables shall include drawings, specifications, and design analysis for the part of design that the Contractor considers ready for review.

#### 3.5.1. Drawings

Include comments from any previous design conferences incorporated into the documents to provide an interim design for the "part" submitted.

### 3.5.2. Design Analyses

3.5.2.1. The designers of record shall prepare and present design analyses with calculations necessary to substantiate and support all design documents submitted. Address design substantiation required by the applicable codes and references and pay particular attention to the following listed items:

3.5.2.2. For parts including sitework, include site specific civil calculations.

3.5.2.3. For parts including structural work, include structural calculations.

- (a) Identify all loads to be used for design.
- (b) Describe the method of providing lateral stability for the structural system to meet seismic and wind load requirements. Include sufficient calculations to verify the adequacy of the method.
- (c) Provide calculations for all principal roof, floor, and foundation members and bracing and secondary members.
- (d) Provide complete seismic analyses for all building structural, mechanical, electrical, architectural, and building features as dictated by the seismic zone for which the facility is being constructed.
- (e) Computer generated calculations must identify the program name, source, and version. Provide input data, including loads, loading diagrams, node diagrams, and adequate documentation to illustrate the design. The schematic models used for input must show, as a minimum, nodes/joints, element/members, materials/properties, and all loadings, induced settlements/deflections, etc., and a list of load combinations. Include an output listing for maximum/minimum stresses/forces and deflections for each element and the reactions for each loading case and combination.
- (f) See also the Security (Anti-Terrorism) requirements below for members subject to Anti-Terrorist Force Protection (ATFP) and Progressive Collapse requirements.
- (g) Fully coordinate and integrate the overall structural design between two different or interfacing construction types, such as modular and stick-built or multistory, stacked modular construction. Provide substantiation of structural, consolidation/settlement analysis, etc., as applicable, through the interfaces.

3.5.2.4. For Security (Anti-Terrorism): Provide a design narrative and calculations where applicable, demonstrating compliance with each of the 22 standards in UFC 4-010-01, which includes Design of Buildings to Resist Progressive Collapse (use the most recent version of UFC 4-023-03, regardless of references to any specific version in UFC 4-010-01). Where sufficient standoff distance is not being provided, show calculations for blast resistance of the structural system and building envelope. Show complete calculations for members subjected to ATFP loads, e.g., support members of glazed items (jambes, headers, sills) connections of windows to support members and connections of support members to the rest of the structure. For 3 story and higher buildings, provide calculations to demonstrate compliance with progressive collapse requirements.

3.5.2.5. For parts including architectural work, include building floor area analysis.

3.5.2.6. For parts including mechanical work, include HVAC analysis and calculations. Include complete design calculations for mechanical systems. Include computations for sizing equipment, compressed air systems, air duct design, and U-factors for ceilings, roofs and exterior walls and floors. Contractor shall employ commercially available energy analysis techniques to determine the energy performance of all passive systems and features. Use of hourly energy load computer simulation is required (see paragraph 3.5.5.2 for list of acceptable software). Based on the results of calculations, provide a complete list of the materials and equipment proposed with the manufacturer's published cataloged product installation specifications and roughing-in data.

3.5.2.7. For parts including life safety, include building code analysis and sprinkler and other suppression systems. Notwithstanding the requirements of the Codes, address the following:

- (a) A registered fire protection engineer (FPE) must perform all fire protection analyses. Provide the fire protection engineer's qualifications. See Section 01 10 00, paragraph 5 for qualifications.

- (b) Provide all references used in the design including Government design documents and industry standards used to generate the fire protection analysis.
- (c) Provide classification of each building in accordance with fire zone, building floor areas and height and number of stories.
- (d) Provide discussion and description of required fire protection requirements including extinguishing equipment, detection equipment, alarm equipment and water supply. Alarm and detection equipment shall interface to requirements of Electronic Systems.
- (e) Provide hydraulic calculations based on water flow test for each sprinkler system to insure that flow and pressure requirements can be met with current water supply. Include copies of Contractor's water flow testing done to certify the available water source.

3.5.2.8. For parts including plumbing systems:

- (a) List all references used in the design.
- (b) Provide justification and brief description of the types of plumbing fixtures, piping materials and equipment proposed for use.
- (c) Detail calculations for systems such as sizing of domestic hot water heater and piping; natural gas piping; LP gas piping and tanks, fuel oil piping and tanks, etc., as applicable.
- (d) When the geotechnical report indicates expansive soils are present, indicate in the first piping design submittal how piping systems will be protected against damage or backfall/backflow due to soil heave (from penetration of slab to the 5 foot building line).

3.5.2.9. For elevator systems:

- (a) List all criteria codes, documents and design conditions used.
- (b) List any required permits and registrations for construction of items of special mechanical systems and equipment.

3.5.2.10. For parts including electrical work, include lighting calculations to determine maintained foot-candle levels, electrical load analysis and calculations, electrical short circuit and protective device coordination analysis and calculations and arc fault calculations.

3.5.2.11. For parts including telecommunications voice/data (including SIPRNET, where applicable), include analysis for determining the number and placement of outlets

3.5.2.12. For Cathodic Protection Systems, provide the following stamped report by the licensed corrosion engineer or NACE specialist with the first design submission. The designer must be qualified to engage in the practice of corrosion control of buried or submerged metallic surfaces. He/she must be accredited or certified by the National Association of Corrosion Engineers (NACE) as a NACE Accredited Corrosion Specialist or a NACE certified Cathodic Protection Specialist, or must be a registered professional engineer with a minimum of five years experience in corrosion control and cathodic protection. Clearly describe structures, systems or components in soil or water to be protected. Describe methods proposed for protection of each.

3.5.3. Geotechnical Investigations and Reports:

3.5.3.1. The contractor's licensed geotechnical engineer shall prepare a final geotechnical evaluation report, to be submitted along with the first foundation design submittal. Make this information available as early as possible during the over-the-shoulder progress review process. Summarize the subsurface conditions and provide recommendations for the design of appropriate utilities, foundations, floor slabs, retaining walls, embankments, and pavements. Include compaction requirements for fill and backfill under buildings, sidewalks, other structures and open areas. Recommend foundation systems to be used, allowable bearing pressures for footings, lateral load resistance capacities for foundation systems, elevations for footings, grade beams, slabs, etc. Provide an assessment of post-construction settlement potential including total and differential. Provide recommendations regarding lateral earth pressures (active, at-rest, passive) to be used in the design of retaining walls. Include the recommended spectral accelerations and Site Class for seismic design along with an evaluation of any seismic hazards and recommendations for mitigation, if required. Include calculations to support the recommendations for bearing capacity, settlement, and pavement sections. Include supporting documentation for all recommended

design parameters such as Site Class, shear strength, earth pressure coefficients, friction factors, subgrade modulus, California Bearing Ratio (CBR), etc. Provide earthwork recommendations, expected frost penetration, expected groundwater levels, recommendations for dewatering and groundwater control and the possible presence of any surface or subsurface features that may affect the construction of the project such as sinkholes, boulders, shallow rock, old fill, old structures, soft areas, or unusual soil conditions. Include pH tests, salinity tests, resistivity measurements, etc., required to design corrosion control and grounding systems. Include the raw field data. Arrange a meeting with the Government subsequent to completion and evaluation of the site specific geotechnical exploration to outline any differences encountered that are inconsistent with the Government provided preliminary soils information. Clearly outline differences which require changes in the foundation type, or pavement and earthwork requirements from that possible and contemplated using the Government furnished preliminary soils investigation, which result in a change to the design or construction. Any equitable adjustment is subject to the provisions of the contract's Differing Site Conditions Clause.

3.5.3.2. Vehicle Pavements: The Contractor's geotechnical report shall contain flexible and rigid pavement designs, as applicable for the project, including design CBR and modulus of subgrade reaction and the required compaction effort for subgrades and pavement layers. Provide Information on the types of base course materials available in the area and design strengths.

3.5.3.3. The Contractor and the professional geotechnical engineer consultant shall certify in writing that the design of the project has been developed consistent with the Contractor's final geotechnical report. The certification shall be stamped by the consulting professional geotechnical engineer and shall be submitted with the first design submission. If revisions are made to the initial design submission, a new certification shall be provided with the final design submission.

#### 3.5.4. LEED Documentation:

Assign a LEED Accredited Professional, responsible to track LEED planning, performance and documentation for each LEED credit through construction closeout. Incorporate LEED credits in the plans, specifications and design analyses. Develop LEED supporting documentation as a separable portion of the Design Analysis and provide with each required design submittal. Include the LEED Project checklist for each non-exempt facility (one checklist may be provided for multiple facilities in accordance with the LEED-NC Application Guide for Multiple Buildings and On-Campus Building Projects and the LEED SUBMITTALS (Attachment E, herein) with each submittal. Final design submittal for each portion of the work must include all required design documentation relating to that portion of work (example - all site credit design documents with final site design). Submittal requirements are as indicated in Attachment E, LEED SUBMITTALS. Submit all documentation indicated on Attachment E as due at final design at final design submittal (for fast-track projects with multiple final design submittals, this shall be at the last scheduled final design submittal). All project documentation related to LEED shall conform to USGBC requirements for both content and format, including audit requirements and be separate from other design analyses. Maintain and update the LEED documentation throughout project progress to construction closeout and shall compile product data, receipts, calculations and other data necessary to substantiate and support all credits claimed. The Government may audit any or all individual credits. Audit documentation is not required to be submitted unless requested. These requirements apply to all projects. If the project requires the Contractor to obtain USGBC certification, the Contractor shall also be responsible for obtaining USGBC certification and shall provide written evidence of certification with the construction closeout LEED documentation submittal. Install the USGBC building plaque at the location indicated by the Government upon receipt. If Contractor obtains USGBC interim design review, submit the USGBC review to the Government within 30 days of receipt for information only.

3.5.4.1. LEED Documentation for Technology Solution Set. If the Solicitation provides a Prescriptive Technology Solution Set, use of the Technology Solution set has no effect on LEED documentation requirements. Provide all required LEED documentation, including energy analysis, in accordance with LEED requirements when using the Technology Solution Set.

#### 3.5.5. Energy Conservation:

3.5.5.1. Refer to Section 01 10 00, Paragraph 5. Interim and Final Design submittals shall demonstrate that each building including the building envelope, HVAC systems, service water heating, power, and lighting systems meet the Mandatory Provisions and the Prescriptive Path requirements of ASHRAE 90.1. Use Compliance Documentation forms available from ASHRAE and included in the ASHRAE 90.1 User's Manual for this purpose. The Architectural Section of the Design Analysis shall include completed forms titled "Building Envelope

Compliance Documentation Parts I and II". The Heating Ventilating and Air Conditioning (HVAC) Section of the Design Analysis shall include a completed form titled "HVAC Simplified Approach Option - Part I" if this approach is allowed by the Standard. Otherwise, the HVAC Section of the Design Analysis shall include completed forms titled "HVAC Mandatory Provisions - Part II" and "HVAC Prescriptive Requirements - Part III". The Plumbing Section of the Design Analysis shall include a completed form titled "Service Water Heating Compliance Documentation". The Electrical Section of the Design Analysis shall include an explanatory statement on how the requirements of ASHRAE 90.1-2004 Chapter 8 Power were met. The Electrical Section of the Design Analysis shall also include a completed form titled "Lighting Compliance Documentation".

3.5.5.2. Interim and Final Design submittals which address energy consuming systems, (heating, cooling, service hot water, lighting, power, etc.) must also include calculations in a separate Energy Conservation Section of the Design Analysis which demonstrate and document (a) the baseline energy consumption for the facility or facilities under contract, that would meet the requirements of ANSI/ASHRAE/IESNA Standard 90.1 and (b) the energy consumption of the facility or facilities under contract utilizing the materials and methods required by this construction contract. Use the USGBC Energy and Atmosphere (EA) Credit 1 compliance template / form or an equivalently detailed form for documenting compliance with the energy reduction requirements. This template / form is titled PERFORMANCE RATING METHOD and is available when the project is registered for LEED. The calculation methodology used for this documentation and analysis shall follow the guidelines set forth in Appendix G of ASHRAE 90.1, with two exceptions: a) receptacle and process loads may be omitted from the calculation; and b) the definition of the terms in the formula for Percentage Improvement found in paragraph G1.2 are modified as follows: Baseline Building Performance shall mean the annual energy consumption calculated for a building design intended for use as a baseline for rating above standard design meeting the minimum requirements of the energy standard, and Proposed Building Performance shall mean annual energy consumption calculated for the proposed building design intended for construction. This calculation shall address all energy consuming systems in a single integrated methodology. Include laboratory fume hoods and kitchen ventilation loads in the energy calculation. They are not considered process loads. Individual calculations for heating, cooling, power, lighting, power, etc. systems will not be acceptable. The following building simulation software is acceptable for use in calculating building energy consumption: Hourly Analysis Program (HAP) by Carrier Corp., TRACE 700 by Trane Corp., DOE-2 by US Department of Energy, EnergyPlus by DOD/DOE.

#### 3.5.6. Specifications

Specifications may be any one of the major, well known master guide specification sources (use only one source) such as MASTERSPEC from the American Institute of Architects, SPECTEXT from Construction Specification Institute or Unified Facility Guide Specifications (UFGS using MASTERFORMAT 2004 numbering system), etc. (including specifications from these sources). Manufacturers' product specifications, utilizing CSI's Manu-Spec, three part format may be used in conjunction with the selected specifications. The designers of record shall edit and expand the appropriate Specifications to insure that all project design requirements, current code requirements, and regulatory requirements are met. Specifications shall clearly identify, where appropriate, specific products chosen to meet the contract requirements (i.e., manufacturers' brand names and model numbers or similar product information).

#### 3.5.7. Building Rendering

Present and provide a draft color computer, artist, or hand drawn rendering with the conceptual design submittal of the building exterior. Perspective renderings shall include a slightly overhead view of the entire building to encompass elevations and the roof configuration of the building. After Government review and acceptance, provide a final rendering, including the following:

Three (3) 18" x 24" color prints, framed and matted behind glass with project title underneath the print.

One (1) Image file (high resolution) in JPG format on CD for those in the submittal distribution list.

#### 3.5.8. Interim Building Design Contents

The following list represents what the Government considers should be included in the overall completed design for a facility or project. It is not intended to limit the contractor from providing different or additional information as needed to support the design presented, including the require design analyses discussed above. As the Contractor develops individual design packages and submits them for Interim review, include as much of the applicable



information for an individual design package as is developed at the Interim design level for review purposes. These pieces shall be developed as the design progresses toward the design complete stage.

#### 3.5.8.1. Lawn and Landscaping Irrigation System

#### 3.5.8.2. Landscape, Planting and Turfing

#### 3.5.8.3. Architectural

- (a) Design Narrative
- (b) Architectural Floor Plans, Typical Wall and Roof Sections, Elevations
- (c) Finish schedule
- (d) All required equipment
- (e) Special graphics requirements
- (f) Door and Window Schedules
- (g) Hardware sets using BHMA designations
- (h) Composite floor plan showing all pre-wired workstations
- (i) Structural Interior Design (SID) package: See ATTACHMENT A for specific requirements
- (j) Furniture, Fixtures & Equipment (FF&E) design package: See ATTACHMENT B for specific requirements

#### 3.5.8.4. Structural Systems. Include:

- (a) Drawings showing principal members for roof and floor framing plans as applicable
- (b) Foundation plan showing main foundation elements where applicable
- (c) Typical sections for roof, floor, and foundation conditions

#### 3.5.8.5. Plumbing Systems

- (a) Show locations and general arrangement of plumbing fixtures and major equipment
- (b) Plan and isometric riser diagrams of all areas including hot water, cold water, waste and vent piping. Include natural gas (and meter as required), (natural gas and meter as required), (LP gas), (fuel oil) and other specialty systems as applicable.
- (c) Include equipment and fixture connection schedules with descriptions, capacities, locations, connection sizes and other information as required

#### 3.5.8.6. HVAC Systems

- (a) Mechanical Floor Plans: The floor plans shall show all principle architectural features of the building which will affect the mechanical design. The floor plans shall also show the following:
  - (1) Room designations.
  - (2) Mechanical legend and applicable notes.
  - (3) Location and size of all ductwork and piping.
  - (4) Location and capacity of all terminal units (i.e., registers, diffusers, grilles, hydronic baseboards).
  - (5) Pre-Fabricated Paint Spray Booth (where applicable to project scope)
  - (6) Paint Preparation Area (where applicable to project scope)
  - (7) Exhaust fans and specialized exhaust systems.
  - (8) Thermostat location.
  - (9) Location of heating/cooling plant (i.e., boiler, chiller, cooling tower, etc).
  - (10) Location of all air handling equipment.

- (11) Air balancing information.
- (12) Flue size and location.
- (13) Piping diagram for forced hot water system (if used).
- (b) Equipment Schedule: Provide complete equipment schedules. Include:
  - (1) Capacity
  - (2) Electrical characteristics
  - (3) Efficiency (if applicable)
  - (4) Manufacturer's name
  - (5) Optional features to be provided
  - (6) Physical size
  - (7) Minimum maintenance clearances
- (a) Details: Provide construction details, sections, elevations, etc., only where required for clarification of methods and materials of design.
- (b) HVAC Controls: Submit complete HVAC controls equipment schedules, sequences of operation, wiring and logic diagrams, Input/Output Tables, equipment schedules, and all associated information. See the Statement of Work for additional specific requirements.

#### 3.5.8.7. Fire Protection and Life Safety.

- (a) Provide plan for each floor of each building that presents a compendium of the total fire protection features being incorporated into the design. Include the following types of information:
  - (1) The location and rating of any fire-resistive construction such as occupancy separations, area separations, exterior walls, shaft enclosures, corridors, stair enclosures, exit passageways, etc.
  - (2) The location and coverage of any fire detection systems
  - (3) The location and coverage of any fire suppression systems (sprinkler risers, standpipes, etc.)
  - (4) The location of any other major fire protection equipment
  - (5) Indicate any hazardous areas and their classification
  - (6) Schedule describing the internal systems with the following information: fire hazard and occupancy classifications, building construction type, GPM/square foot sprinkler density, area of operation and other as required
- (b) Working plans and all other materials submitted shall meet NFPA 13 requirements, with respect to required minimum level of detail.

#### 3.5.8.8. Elevators. Provide:

- (a) Description of the proposed control system
- (b) Description, approximate capacity and location of any special mechanical equipment for elevators.

#### 3.5.8.9. Electrical Systems.

- (a) Electrical Floor Plan(s): Show all principle architectural features of the building which will affect the electrical design. Show the following:
  - (1) Room designations.
  - (2) Electrical legend and applicable notes.
  - (3) Lighting fixtures, properly identified.
  - (4) Switches for control of lighting.
  - (5) Receptacles.

- (6) Location and designation of panelboards. Clearly indicate type of mounting required (flush or surface) and reflect accordingly in specifications.
- (7) Service entrance (conduit and main disconnect).
- (8) Location, designation and rating of motors and/or equipment which requires electrical service. Show method of termination and/or connection to motors and/or equipment. Show necessary junction boxes, disconnects, controllers (approximate only), conduit stubs, and receptacles required to serve the motor and/or equipment.
- (b) Building Riser Diagram(s) (from pad-mounted transformer to unit load center panelboard): Indicate the types and sizes of electrical equipment and wiring. Include grounding and metering requirements.
- (c) Load Center Panelboard Schedule(s): Indicate the following information:
  - (1) Panelboard Characteristics (Panel Designation, Voltage, Phase, Wires, Main Breaker Rating and Mounting.
  - (2) Branch Circuit Designations.
  - (3) Load Designations.
  - (4) Circuit Breaker Characteristics. (Number of Poles, Trip Rating, AIC Rating)
  - (5) Branch Circuit Connected Loads (AMPS).
  - (6) Special Features
- (d) Lighting Fixture Schedule(s): Indicate the following information:
  - (1) Fixture Designation.
  - (2) General Fixture Description.
  - (3) Number and Type of Lamp(s).
  - (4) Type of Mounting.
  - (5) Special Features.
- (e) Details: Provide construction details, sections, elevations, etc. only where required for clarification of methods and materials of design.

3.5.8.10. Electronic Systems including the following responsibilities:

- (a) Fire Detection and Alarm System. Design shall include layout drawings for all devices and a riser diagram showing the control panel, annunciator panel, all zones, radio transmitter and interfaces to other systems (HVAC, sprinkler, etc.)
- (b) Fire Suppression System Control. Specify all components of the Fire Suppression (FS) System in the FS section of the specifications. Clearly describe how the system will operate and interact with other systems such as the fire alarm system. Include a riser diagram on the drawings showing principal components and interconnections with other systems. Include FS system components on drawing legend. Designate all components shown on floor plans "FS system components" (as opposed to "Fire Alarm components"). Show location of FS control panels, HVAC control devices, sensors, and 120V power panel connections on floor plans. Indicate zoning of areas by numbers (1, 2, 3) and detectors sub-zoned for cross zoning by letter designations (A and B). Differentiate between ceiling mounted and under floor detectors with distinct symbols and indicate sub-zone of each.
- (c) Public Address System
- (d) Special Grounding Systems. Completely reflect all design requirements in the specifications and drawings. Specifications shall require field tests (in the construction phase), witnessed by the Government, to determine the effectiveness of the grounding system. Include drawings showing existing construction, if any.
- (e) Cathodic Protection.
- (f) Intrusion Detection, Card Access System
- (g) Central Control and Monitoring System
- (h) Mass Notification System
- (i) Electrical Power Distribution Systems

#### 3.5.8.11. Information Systems including the following responsibilities:

- (a) Telecommunications Cabling
- (b) Supporting Infrastructure
- (a) Outside Plant (OSP) Cabling - Campus or Site Plans - Exterior Pathways and Inter-Building Backbones
  - (a) Include a layout of the voice/data outlets (including voice only wall & pay phones) on telecommunication floor plan drawing, location of SIPRNET data outlets (where applicable), and a legend and symbol definition to indicate height above finished floor. Show size of conduit and cable type and size on Riser Diagram. Do not show conduit runs between backboard and outlets on the floor plans. Show underground distribution conduit and cable with sizing from point of presence to entrance facility of building.
  - (b) Layout of complete building per floor - Serving Zone Boundaries, Backbone Systems, and Horizontal Pathways including Serving Zones Drawings - Drop Locations and Cable ID's
  - (c) Communication Equipment Rooms - Plan Views - Tech and AMEP/Elevations - Racks and Walls. Elevations with a detailed look at all telecomm rooms. Indicate technology layout (racks, ladder-racks, etc.), mechanical/electrical layout, rack elevation and backboard elevation. They may also be an enlargement of a congested area of T1 or T2 series drawing.

#### 3.6. FINAL DESIGN REVIEWS AND CONFERENCES

A final design review and review conference will be held upon completion of final design at the project installation, or – where equipment is available - by video teleconference or a combination thereof, for any design package to receive Government acceptance to allow release of the design package for construction. For smaller separate design packages, the parties may agree on alternative reviews and conferences (e.g., conference calls and electronic file sharing, etc.) through the Partnering process. Include the final design conference in the project schedule and shall indicate what part of the design work is at 100% completion. The final design conference will be held after the Government has had seven (7) calendar days after receipt of the submission to review the final design package and supporting data. For smaller packages, especially those involving only one or a few design disciplines the parties may agree on a shorter period.

#### 3.7. FINAL DESIGN REQUIREMENTS

Final design deliverables for a design package shall consist of 100% complete drawings, specifications, submittal register and design analyses for Government review and acceptance. The 100% design submission shall consist of drawings, specifications, updated design analyses and any permits required by the contract for each package submitted. In order to expedite the final design review, prior to the conference, ensure that the design configuration management data and all review comment resolutions are up-to-date. Include the 100% SID and 100% FF&E binders for government approval. The Contractor shall have performed independent technical reviews (ITR's) and back-checks of previous comment resolutions, as required by Section 01 45 04.00 10 CONTRACTOR QUALITY CONTROL, including providing documentation thereof.

##### 3.7.1. Drawings

3.7.1.1. Submit drawings complete with all contract requirements incorporated into the documents to provide a 100% design for each package submitted.

3.7.1.2. Prepare all drawings with the Computer-Aided Design and Drafting (CADD)/Computer-Aided Design (CAD) system, organized and easily referenced electronically, presenting complete construction information.

3.7.1.3. Drawings shall be complete. The Contractor is encouraged to utilize graphics, views, notes, and details which make the drawings easier to review or to construct but is also encouraged to keep such materials to those that are necessary.

3.7.1.4. Provide detail drawings that illustrate conformance with the contract. Include room finish schedules, corresponding color/finish/special items schedules, and exterior finish schedules that agree with the submitted SID binders.

3.7.1.5. The design documents shall be in compliance with the latest version of the A/E/C CADD Standard, available at <https://cadbim.usace.army.mil/CAD>. Use the approved vertical Corps of Engineers title blocks and borders on all drawings with the appropriate firm name included within the title block area.

3.7.1.6. CAD System and Building Information Modeling (BIM) (NOTE: If this is a Single Award or Multiple Award, Indefinite Delivery/Indefinite Quantity Contract, this information will be provided for each task order.)

All CAD files shall be fully compatible with MicroStation V8 or higher. Save all design CAD files as MicroStation V8 or higher files. All submitted BIM Models and associated Facility Data shall be fully compatible with Bentley BIM file format and the USACE Bentley BIM v8 Workspace.

(a) CAD Data Final File Format: During the design development capture geo-referenced coordinates of all changes made to the existing site (facility footprint, utility line installations and alterations, roads, parking areas, etc) as a result of this contract. There is no mandatory methodology for how the geo-referenced coordinates will be captured, however, Engineering and Construction Bulletin No. 2006-15, Subject: Standardizing Computer Aided Design (CAD) and Geographic Information Systems (GIS) Deliverables for all Military Design and Construction Projects identifies the format for final as-built drawings and data sets to be delivered to the government. Close-out requirements at the as-built stage; require final geo-referenced GIS Database of the new facility along with all exterior modifications. The Government will incorporate this data set into the Installation's GIS Masterplan or Enterprise GIS System. See also, Section 01 78 02.00 10 Closeout Submittals.

(b) Electronic Drawing Files: In addition to the native CAD design files, provide separate electronic drawing files (in editable CAD format and Adobe Acrobat PDF version 7.0 or higher) for each project drawing.

(c) Each file (both CAD and PDF) shall represent one complete drawing from the drawing set, including the date, submittal phase, and border. Each drawing file shall be completely independent of any data in any other file, including fonts and shapes not included with the basic CAD software program utilized. Drawing files with external references or special fonts are not acceptable. All displayed graphic elements on all levels of the drawing files shall be part of the project drawing image. The drawing files shall not contain any graphic element that is not part of the drawing image.

(d) Deliver BIM Model and associated Facility Data files in their native format. At a minimum, BIM files shall address major architecture design elements, major structural components, mechanical systems and electrical/communication distribution and elements as defined in Attachment F. See Attachment F for additional BIM requirements.

(e) Drawing Index: Provide an index of drawings sheet in CAD as part of the drawing set, and an electronic list in Microsoft Excel of all drawings on the CD. Include the electronic file name, the sheet reference number, the sheet number, and the sheet title, containing the data for each drawing.

(f) Hard Copies: Plot submitted hard copy drawings directly from the "electronic drawing files" and copy for quantities and sizes indicated in the distribution list at the end of this specification section. The Designers of Record shall stamp, sign and date original hard copy sheets as Released For Construction, and provide copies for distribution from this set.

### 3.7.2. Design Analyses

3.7.2.1. The designers of record shall update, finalize and present design analyses with calculations necessary to substantiate and support all design documents submitted.

3.7.2.2. The responsible DOR shall stamp, sign and date the design analysis. Identify the software used where, applicable (name, version, vendor). Generally, provide design analyses, individually, in an original (file copy) and one copy for the assigned government reviewer.

3.7.2.3. All disciplines review the LEED design analysis in conjunction with their discipline-specific design analysis; include a copy of the separable LEED design analysis in all design analysis submittals.

3.7.2.4. Do not combine multi-disciplined volumes of design-analysis, unless multiple copies are provided to facilitate multiple reviewers (one copy per each separate design analysis included in a volume).

### 3.7.3. Specifications

Specifications shall be 100% complete and in final form.

#### 3.7.4. Submittal Register

Prepare and update the Submittal Register and submit it with the 100% design specifications (see Specification Section 01 33 00, SUBMITTAL PROCEDURES) with each design package. Include the required submittals for each specification section in a design package in the submittal register.

#### 3.7.5. Preparation of DD Form 1354 (Transfer of Real Property)

This form itemizes the types, quantities and costs of various equipment and systems that comprise the project, for the purpose of transferring the new construction project from the Corps Construction Division to the Installation's inventory of real property. The Government will furnish the DB Contractor's design manager a DD Form 1354 checklist to use to produce a draft Form 1354. Submit the completed checklist and prepared draft Form DD 1354 with the 100% design in the Design Analysis. The Corps will use these documents to complete the final DD 1354 upon completion of construction.

#### 3.7.6. Acceptance and Release for Construction

3.7.6.1. At the conclusion of the Final Design Review (after resolutions to the comments have been agreed upon between DOR and Government reviewers), the Contracting Officer or the ACO will accept the Final Design Submission for the design package in writing and allow construction to start for that design package. The Government may withhold acceptance until all major corrections have been made or if the final design submission requires so many corrections, even though minor, that it isn't considered acceptably complete.

3.7.6.2. Government review and acceptance of design submittals is for contract conformance only and shall not relieve the Contractor from responsibility to fully adhere to the requirements of the contract, including the Contractor's accepted contract proposal, or limit the Contractor's responsibility of design as prescribed under Special Contract Requirement: "Responsibility of the Contractor for Design" or limit the Government's rights under the terms of the contract. The Government reserves the right to rescind inadvertent acceptance of design submittals containing contract deviations not separately and expressly identified in the submittal for Government consideration and approval.

### 3.8. DESIGN COMPLETE CONSTRUCTION DOCUMENT REQUIREMENTS

After the Final Design Submission and Review Conference and after Government acceptance of the Final Design submission, revise the design documents for the design package to incorporate the comments generated and resolved in the final review conference, perform and document a back-check review and submit the final, design complete documents. Label the final design complete documents "FOR CONSTRUCTION" or use similar language. In addition to the final drawings and specifications, the following deliverables are required for distribution and field use. The deliverable includes all documentation and supporting design analysis in final form, as well as the final review comments, disposition and the back-check. As part of the quality assurance process, the Government may perform a back-check of the released for construction documentation. Promptly correct any errors or omissions found during the Government back-check. The Government may withhold retainage from progress payments for work or materials associated with a final design package until this submittal has been received and the Government determines that it is complete.

### 3.9. SUBMITTAL DISTRIBUTION, MEDIA AND QUANTITIES

#### 3.9.1. Submittal Distribution and Quantities

General: The documents which the Contractor shall submit to the Government for each submittal are listed and generally described in preceding paragraphs in this Section. Provide copies of each design submittal and design substantiation as follows (NOTE: If this is a Single Award or Multiple Award, Indefinite Delivery/Indefinite Quantity Contract, this information will be provided for each task order):

Activity and Address	Drawing Size (Full Size) <b>Full</b> Full Sets/ *Partial Sets	Design Analyses & Specs Full Sets/ *Partial Sets	Drawing Size (Half Size) <b>Half Size</b> Full Sets/ *Partial Sets	Non-BIM Data CD-ROM or DVD as Necessary (PDF& <u>.dgn</u> )	Furniture Submittal (FFE)	Structural Interior Design Submittal	BIM Data DVD (Per Attach F)
Commander, U.S.Army Engineer District <b>Fort Worth District</b>	0/0	2/2	2/2	5	1	1	1
Commander, U.S.Army Engineer District, Center of Standardization <b>Omaha District</b>	0/0	2/2	2/2	2	1	1	2
Installation	0/0	4/2	4/2	4	2	2	2
U.S.Army Corps of Engineers Construction Area Office	1/1	1/1	4/2	2	1	1	1
Information Systems Engineering Command (ISEC)	0/0	0/1	0/0	1	1 (Electronic only)	N/A	1
Other Offices	0/0	1/1	1/1	1	1	1	1

**\*NOTE: For partial sets of drawings, specifications and design analyses, see paragraph 3.9.3.3, below.**

**\*\*NOTE: When specified below in 3.9.2, furnish Installation copies of Drawings as paper copies, in lieu of the option to provide secure web-based submittals.**

### 3.9.2. Web based Design Submittals

Web based design submittals will be acceptable as an alternative to the paper copies listed in the Table above, provided a single hard-copy PDF based record set is provided to the Contracting Officer for record purposes. Where the contract requires the Contractor to submit documents to permitting authorities, still provide those authorities paper copies (or in an alternate format where required by the authority). Web based design submittal information shall be provided with adequate security and availability to allow unlimited access those specifically authorized to Government reviewers while preventing unauthorized access or modification. File sizes must be of manageable size for reviewers to quickly download or open on their computers. As a minimum, drawings shall be full scale on American National Standards Institute (ANSI) D sheets (34" x 22"). In addition to the optional website, provide the BIM data submission on DVD to each activity and address noted above in paragraph 3.9.1 for each BIM submission required in Attachment F.

### 3.9.3. Mailing of Design Submittals

3.9.3.1. Mail all design submittals to the Government during design and construction, using an overnight mailing service. The Government will furnish the Contractor addresses where each copy shall be mailed to after award of the contract (or individual task order if this is an indefinite delivery/indefinite quantity, task order contract). Mail the submittals to six (6) different addresses. Assemble drawing sheets, specs, design analyses, etc. into individual sets; do not combine duplicate pages from individual sets so that the government has to assemble a set.

3.9.3.2. Each design submittal shall have a transmittal letter accompanying it indicating the date, design percentage, type of submittal, list of items submitted, transmittal number and point of contact with telephone number.

3.9.3.3. Provide partial sets of drawings, specifications, design analyses, etc., as designated in the Table in paragraph 3.9.1, to those reviewers who only need to review their applicable portions of the design, such as the various utilities. The details of which office receives what portion of the design documentation will be worked out after award.

### 3.10. AS-BUILT DOCUMENTS

Provide as-built drawings and specifications in accordance with Section 01 78 02.00 10, CLOSEOUT SUBMITTALS. Update LEED design phase documentation during construction as needed to reflect construction changes and advancing project completion status (example - Commissioning Plan updates during construction phase) and include updated LEED documentation in construction closeout submittal.



## **ATTACHMENT A STRUCTURAL INTERIOR DESIGN (SID) REQUIREMENTS**

### **1.0 GENERAL INFORMATION**

Structural Interior Design includes all building related elements and components generally part of the building itself, such as wall finishes, ceilings finishes, floor coverings, marker/bulletin boards, blinds, signage and built in casework. Develop the SID in conjunction with the furniture footprint.

### **2.0 STRUCTURAL INTERIOR DESIGN (SID) REQUIREMENTS FOR THE INTERIM AND FINAL DESIGN SUBMITTALS**

#### **2.1. FORMAT AND SCHEDULE**

Prepare and submit for approval an interior and exterior building finishes scheme for an interim design submittal. The DOR shall meet with and discuss the finish schemes with the appropriate Government officials prior to preparation of the schemes to be presented. Present original sets of the schemes to reviewers at an interim design conference.

At the conclusion of the interim phase, after resolutions to the comments have been agreed upon between DOR and Government reviewers, the Contractor may proceed to final design with the interior finishes scheme presented.

The SID information and samples are to be submitted in 8 ½" x 11" format using three ring binders with pockets on the inside of the cover. When there are numerous pages with thick samples, use more than one binder. Large D-ring binders are preferred to O-ring binders. Use page protectors that are strong enough to keep pages from tearing out. Anchor large or heavy samples with mechanical fasteners, Velcro, or double-faced foam tape rather than rubber cement or glue. Fold out items must have a maximum spread of 25 ½". Provide cover and spine inserts sheets identifying the document as "Structural Interior Design" package. Include the project title and location, project number, Contractor/A/E name and phone number(s), submittal stage and date.

Design submittal requirements include, but are not limited to:

##### **2.1.1. Narrative of the Structural Interior Design Objectives**

The SID shall include a narrative that discusses the building related finishes. Include topics that relate to base standards, life safety, sustainable design issues, aesthetics, durability and maintainability, discuss the development and features as they relate to the occupants requirements and the building design.

##### **2.1.2. Interior Color Boards**

Identify and key each item on the color boards to the contract documents to provide a clear indication of how and where each item will be used. Arrange finish samples to the maximum extent possible by room type in order to illustrate room color coordination. Label all samples on the color boards with the manufacturer's name, patterns and colors name and number. Key or code samples to match key code system used on contract drawings.

Material and finish samples shall indicate true pattern, color and texture. Provide photographs or colored photocopies of materials or fabrics to show large overall patterns in conjunction with actual samples to show the actual colors. Finish samples must be large enough to show a complete pattern or design where practical.

Color boards shall include but not be limited to original color samples of the following:

All walls finishes and ceiling finishes, including corner guards, acrylic wainscoting and wall guards/chair rail finishes

All tile information, including tile grout color and tile patterns.

- All flooring finishes, including patterns.
- All door, door frame finishes and door hardware finishes
- All signage, wall base, toilet partitions, locker finishes and operable/folding partitions and trim

- All millwork materials and finishes (cabinets, counter tops, etc.)
- All window frame finishes and window treatments (sills, blinds, etc.)

Color board samples shall reflect all actual finish textures, patterns and colors required as specified. Patterned samples shall be of sufficient size to adequately show pattern and its repeat if a repeat occurs.

#### 2.1.3. Exterior Color Boards

Prepare exterior finishes color boards in similar format as the interior finishes color boards, for presentation to the reviewers during an interim design conference. Provide original color samples of all exterior finishes including but not limited to the following:

- All Roof Finishes
- All Brick and Cast Stone Samples
- All Exterior Insulation and Finish Samples
- All Glass Color Samples
- All Exterior Metals Finishes
- All Window & Door Frame Finishes
- All Specialty Item Finishes, including trim

Identify each item on the exterior finishes color boards and key to the building elevations to provide a clear indication of how and where each item will be used.

### 2.2. STRUCTURAL INTERIOR DESIGN DOCUMENTS

#### 2.2.1. General

Structural interior design related drawings must indicate the placement of extents of SID material, finishes and colors and must be sufficiently detailed to define all interior work. The following is a list of minimum requirements:

#### 2.2.2. Finish Color Schedule

Provide finish color schedule(s) in the contract documents. Provide a finish code, material type, manufacturer, series, and color designations. Key the finish code to the color board samples and drawings.

#### 2.2.3. Interior Finish Plans

Indicate wall and floor patterns and color placement, material transitions and extents of interior finishes.

#### 2.2.4. Furniture Footprint Plans

Provide furniture footprint plans showing the outline of all freestanding and systems furniture for coordination of all other disciplines.

#### 2.2.5. Interior Signage

Include interior signage plans or schedules showing location and quantities of all interior signage. Key each interior sign to a quantitative list indicating size, quantity of each type and signage text.

#### 2.2.6. Interior Elevations, Sections and Details

Indicate material, color and finish placement.

## **ATTACHMENT B FURNITURE, FIXTURES & EQUIPMENT (FF&E) REQUIREMENTS**

### **1.0 FF&E REQUIREMENTS FOR THE INTERIM AND FINAL DESIGN SUBMITTALS**

#### **1.1. FORMAT AND SCHEDULE**

Prepare and submit for approval a comprehensive FF&E scheme for an interim design submittal. The Contractor's interior designer, not a furniture dealer, shall develop the design. FF&E is the selection, layout, specification and documentation of furniture includes but is not limited to workstations, seating, tables, storage and shelving, filing, trash receptacles, clocks, framed artwork, artificial plants, and other accessories. Contract documentation is required to facilitate pricing, procurement and installation. The FF&E package is based on the furniture footprint developed in the Structural Interior Design (SID) portion of the interior design. Develop the FF&E package concurrently with the building design to ensure that there is coordination between the electrical outlets, switches, J-boxes, communication outlets and connections, and lighting as appropriate. In addition, coordinate layout with other building features such as architectural elements, thermostats, location of TV's, GF/GI equipment (for example computers, printers, copiers, shredders, faxes), etc. Locate furniture in front of windows only if the top of the item falls below the window and unless otherwise noted, do not attach furniture including furniture systems to the building. If project has SIPRNET and/or NIPRNET, coordinate furniture layout with SIPRNET and NIPRNET separation requirements. Verify that access required by DOIM for SIPRNET box and conduit is provided. The DOR shall interview appropriate Government personnel to determine FF&E requirements for furniture and furnishings prior to preparation of the scheme to be presented. Determine FFE items and quantities by, but not limited to: (1) the number of personnel to occupy the building, (2) job functions and related furniture/office equipment to support the job function, (3) room functions, (4) rank and grade. Present original sets of the scheme to reviewers at an interim design conference upon completion of the interim architectural submittal or three months prior to the submittal of the final FF&E package (whichever comes first).

Design may proceed to final with the FF&E scheme presented at the conclusion of the interim phase, after resolutions to the comments have been agreed upon between DOR and Government reviewers.

Provide six copies of the electronic versions of all documents upon completion of the final architectural submittal or ten months prior to the contract completion date (whichever comes first), to ensure adequate time for furniture acquisition. Provide unbound, electronic drawings in CAD and BIM. Provide all files needed to view complete drawings. Submit all text documents in Microsoft Word or Excel..

Submit three copies of the final and complete FF&E information and samples in 8 ½" x 11" format using three ring binders with pockets on the inside of the cover upon completion of the final architectural submittal or ten months prior to the contract completion date (whichever comes first). Use more than one binder when there are numerous pages with thick samples. Large D-ring binders are preferred to O-ring binders. Use page protectors that are strong enough to keep pages from tearing out for upholstery and finish boards. Anchor large or heavy samples with mechanical fasteners, Velcro, or double-faced foam tape rather than rubber cement or glue. Fold out items must have a maximum spread of 25 ½". Provide cover and spine inserts sheets identifying the document as "Furniture, Fixtures & Equipment" package and include the project title and location, project number, Contractor/A/E name and phone number(s), submittal stage and date.

Provide electronic copies of all documents upon completion of the final architectural submittal or ten months prior to the contract completion date (whichever comes first), to ensure adequate time for furniture acquisition. Provide six compact disks with all drawings files needed to view the complete drawings unbound and in the latest version AutoCAD. Provide six additional compact disks of all text documents in Microsoft Word or Excel.

Design submittal requirements include, but are not limited to:

##### **1.1.1. Narrative of Interior Design Objectives**

Provide a narrative description of the furniture, to include functional, safety and ergonomic considerations, durability, sustainability, aesthetics, and compatibility with the building design.

##### **1.1.2. Furniture Order Form**

Prepare one Furnishings Order Form for each item specified in the design. This form identifies all information required to order each individual item. In addition to the project name and location, project number, and submittal phase, the order form must include:

- (a) Furniture item illustration and code
- (b) Furniture item name
- (c) Job name, location, and date
- (d) General Services Administration (GSA) FSC Group, part, and section
- (e) Manufacturer, Product name and Product model number or National Stock Number (NSN)
- (f) Finish name and number (code to finish samples)
- (g) Fabric name and number, minimum Wyzenbeek Abrasion Test double rubs (code to fabric samples)
- (h) Dimensions
- (i) Item location by room number and room name
- (j) Quantity per room
- (k) Total quantity
- (l) Special instructions for procurement ordering and/or installation (if applicable)
- (m) Written Product Description: include a non-proprietary paragraph listing the salient features of the item to include but not limited to:
  - (1) required features and characteristics
  - (2) ergonomic requirements
  - (3) functional requirements
  - (4) testing requirements
  - (5) furniture style
  - (6) construction materials
  - (7) minimum warranty

The following is an example for “m” features and characteristics, ergonomic requirements and functional requirements:

Chair Description:

- (1) Mid-Back Ergonomic Task Chair
- (2) Pneumatic Gaslift; Five Star Base
- (3) Mesh Back; Upholstered Seat
- (4) Height and Width Adjustable Task Arms:
  - a. Arm Height: 6”- 11” (+-1/2”)
  - b. Arm Width: 2”– 4” adjustment
- (5) Height Adjustable Lumbar Support
- (6) Adjustable Seat Height 16”-21” (+- 1”)
- (7) Sliding Seat Depth Adjustment 15”-18” (+-1”)
- (8) Standard Hard Casters (for carpeted areas)
- (9) Overall Measurements:
  - a. Overall width: 25” - 27”
  - b. Overall depth: 25”– 28”

(10) Must have a minimum of the following adjustments (In addition to the above):

- a. 360 Degree Swivel
- b. Knee-Tilt with Tilt Tension
- c. Back angle
- d. Forward Tilt
- e. Forward Tilt and Upright Tilt Lock

For projects with systems furniture, also provide a written description of the following minimum requirements:

- (1) Type furniture systems (panel, stacking panels, spine wall, desk based system, or a combination)
- (2) Minimum noise reduction coefficient (NRC)
- (3) Minimum sound transfer coefficient (STC)
- (4) Minimum flame spread and smoke development
- (5) UL testing for task lighting and electrical system
- (6) Panel widths and heights and their locations (this may be done on the drawings) Worksurface types and sizes (this may be done on the drawings)
- (7) Worksurface edge type
- (8) Varying panel/cover finish materials and locations (locations may be shown on the drawings)
- (9) Storage requirements
- (10) Keyboard requirements
- (11) Lock and keying requirements
- (12) Accessory components (examples: tack boards, marker boards, paper management)
- (13) Electrical and communication raceway requirement; type, capacity and location (base, beltline, below and/or above beltline)
- (14) Locations of communication cables (base, beltline, below and/or above beltline, top channel)
- (15) Types of electrical outlets
- (16) Types of communication jacks; provided and installed by others
- (17) Locations of electrical outlets and communication jacks (this may be done on the drawings)
- (18) Type of cable (examples: Cat. 5, Cat. 6, fiber optic; UTP or STP, etc.) system needs to support; provided and installed by others

#### 1.1.3. Alternate Manufacturer List

Provide a table consisting of major furniture items that lists the manufacturers products specified on the Order Form and two alternate manufacturers. Major furniture items include, but are not limited to, casegoods, furniture systems, seating, and tables. Organize matrix by item code and item name. Supply alternates that are available on GSA Schedule and meet the requirements of the Furniture Order Form. One of the two alternates must be from UNICOR if possible. Provide manufacturer name address, telephone number, product series and product name for each alternate manufacturer.

#### 1.1.4. FF&E Procurement List

Provide a table that lists all FF&E furniture, mission unique equipment and building Contractor Furnished/Contractor Installed (CF/CI) items. Give each item a code and name and designate whether item will be procured as part of the FF&E furniture, mission unique equipment or the building construction contract. Use the item code to key all FF&E documents including location plans, color boards, data sheets, cost estimate, etc.

#### 1.1.5. Points of Contact (POCs)

Provide a comprehensive list of POCs needed to implement the FF&E package. This would include but not be limited to appropriate project team members, using activity contacts, interior design representatives, construction contractors and installers involved in the project. In addition to name, address, phone, fax and email, include each contact's job function. Divide the FF&E package into different sections based on this listing, applies to order forms and cost estimates.

#### 1.1.6. Color Boards

Provide color boards for all finishes and fabrics for all FF&E items. Finishes to be included but not limited to paint, laminate, wood finish, fabric, etc.

#### 1.1.7. Itemized Furniture Cost Estimate

Provide an itemized cost estimate of furnishings keyed to the plans and specifications of products included in the package. This cost estimate should be based on GSA price schedules. The cost estimate must include separate line items for general contingency, installation, electrical hook-up for systems furniture or other furniture requiring hardwiring by a licensed electrician, freight charges and any other related costs. Installation and freight quotes from vendors should be use in lieu of a percentage allowance when available. Include a written statement that the pricing is based on GSA schedules. An estimate developed by a furniture dealership may be provided as support information for the estimate, but must be separate from the contractor provided estimate.

### 1.2. INTERIOR DESIGN DOCUMENTS

#### 1.2.1. Overall Furniture and Area Plans

Provide floor Plans showing locations and quantities of all freestanding, and workstation furniture proposed for each floor of the building. Key each room to a large scale Furniture Placement Plan showing the furniture configuration, of all furniture. Provide enlarged area plans with a key plan identifying the area in which the building is located. Key all the items on the drawings by furniture item code. Do not provide manufacturer specific information such as product names and numbers on drawings, Drawings shall be non-proprietary. This is typical for FFE on all plans, including those mentioned below.

#### 1.2.2. Workstation Plans

Show each typical workstation configuration in plan view, elevations or isometric view. Drawings shall illustrate panels and all major components for each typical workstation configuration. Identify workstations using the same numbering system as shown on the project drawings. Key components to a legend on each sheet which identifies and describes the components along with dimensions. Provide the plan, elevations and isometric of each typical workstation together on the same drawing sheet.

#### 1.2.3. Panel Plans

Show panel locations and critical dimensions from finished face of walls, columns, panels including clearances and aisle widths. Key panel assemblies to a legend which shall include width, height, configuration of frames, panel fabric and finishes (if there are different selections existing within a project), powered or non-powered panel and wall mount locations.

#### 1.2.4. Desk Plans

Provide typical free standing desk configurations in plan view, elevation or isometric view and identify components to clearly represent each desk configuration.

#### 1.2.5. Reflected Ceiling Plans

Provide typical plans showing ceiling finishes and heights, lighting fixtures, heating ventilation and air conditioning supply and return, and sprinkler head placement for coordination of furniture.

#### 1.2.6. Electrical and Telecommunication Plans

Show power provisions including type and locations of feeder components, activated outlets and other electrical components. Show locations and quantities of outlets for workstations. Clearly identify different outlets, i.e. electrical, LAN and telecommunication receptacles indicating each type proposed. Show wiring configuration, (circuiting, switching, internal and external connections) and provide as applicable.

#### 1.2.7. Artwork Placement Plans

Provide an Artwork Placement Plan to show location of artwork, assign an artwork item code to each piece of artwork. As an alternative, artwork can be located on the Furniture Plans. Provide a schedule that identifies each piece by room name and number. Provide installation instructions; include mounting height.

#### 1.2.8. Window Drapery Plans

Provide Interior Window Drapery Plans. Key each drapery treatment to a schedule showing color, pattern, material, drapery size and type, draw direction, location and quantities.

### 1.3. FURNITURE SELECTION

1.3.1. Select furniture from the GSA Schedules. Specify furniture available open market when an item is not available on the GSA Schedules. Provide justification for items not available on the GSA Schedules.

1.3.2. To the greatest extent possible when specifying furniture work within a manufacturer's family of furniture for selections, example: Steelcase, Turnstone, Brayton International, Metro, and Vecta are all Steelcase companies. Each alternate should also be specified from a manufacturer's family of furniture, example: first set of alternates would be specified from Knoll's family of furniture and the second from Herman Miller family of furniture. It may be necessary to make some selections from other than a manufacturer's family of furniture if costs are not reasonable for particular items, some items are not available or appropriate for the facility or the items are not on GSA Schedule. If this occurs, consider specifying product from an open line that is accessible by numerous dealerships. Select office furniture including case goods, tables, storage, seating, etc. that is compatible in style, finish and color. Select furniture that complies with ANSI/BIFMA and from manufacturer's standard product line as shown in the most recent published price list and/or amendment and not custom product.

### 1.4. CONSTRUCTION

1.4.1. Provide knee space at workstations and tables that is not obstructed by panels/legs that interfere with knee space of seated person and provide desks, storage and tables with leveling devices to compensate for uneven floors.

1.4.2. Provide worksurface tops constructed to prevent warpage. Provide user friendly features such as radius edges. Do not use sharp edges and exposed connections and ensure the underside of desks, tables and worksurfaces are completely and smoothly finished. Provide abutting worksurfaces that mate closely and are of equal heights when used in side-by-side configurations in order to provide a continuous and level worksurface.

1.4.3. Drawers shall stay securely closed when in the closed position and protect wires from damage during drawer operation. Include a safety catch to prevent accidental removal when fully open.

1.4.4. Unless otherwise noted, specify lockable desks and workstations and storage of steel construction. Use tempered glass glazing when glazing is required.

### 1.5. FINISHES AND UPHOLSTERY

1.5.1. Specify neutral colors for casegoods, furniture systems, storage and tables. Specify desk worksurfaces and table tops that are not too light or too dark in color and have a pattern to help hide soiling. Accent colors are allowed in break and lounge areas. Keep placement of furniture systems panel fabric accent colors to a minimum. All finishes shall be cleanable with ordinary household cleaning solutions.

1.5.2. Use manufacturer's standard fabrics; including textile manufacturers fabrics that have been graded into the furniture manufacturers fabric grades and are available through their GSA Schedule. Customers Own Material

(COM) can be used in headquarter buildings in command suites with executive furniture. Coordinate specific locations with Corps of Engineers Interior Designer.

1.5.3. Specify seating upholstery that meets Wyzenbeek Abrasion Test, 55,000 minimum rubs. Specify a soil retardant finish for woven fabrics if Crypton or vinyl upholstery is not provided for seating in dining areas. Use manufacturer's standard fabrics. This includes textile manufacturers fabrics that have been graded into the furniture manufactures fabric grades and are available through their GSA Schedule. Specify upholstery and finish colors and patterns that help hide soiling. Specify finishes that can be cleaned with ordinary household cleaning solutions.

#### 1.6. ACCESSORIES

1.6.1. Specify all accessories required for completely finished furniture installation. Provide filing cabinets and storage for office supplies. Provide tack surfaces at workstations with overhead storage. Provide tackable surfaces at workstations with overhead storage.

1.6.2. Not Used.

1.6.3. Workstations are to be equipped with stable keyboard trays that have height adjustability, tilting capability, including negative tilt, have a mouse pad at same height as the keyboard tray that can accommodate both left and right handed users, and retractable under worksurface.

#### 1.7. MISSION UNIQUE EQUIPMENT

Funding for FF&E furniture items and mission unique equipment (MUE) items are from two different sources. Separate the designs and procurement documentation for FFE items and MUE. MUE includes, but is not limited to, items such as industrial shelving, workbenches, appliances, fitness equipment, IT equipment and supporting carts. The User will purchase and install mission unique equipment items, unless otherwise noted. Identify locations of known MUE items such as industrial shelving, workbenches, appliances, etc. for space planning purposes.

#### 1.8. SUSTAINABILITY

1.8.1. For all designs provided regardless of facility type, make every effort to implement all aspects of sustainability to the greatest extent possible for all the selections made in the FF&E package. This includes but is not limited to the selection of products that consider: **Material Chemistry and Safety of Inputs** (What chemicals are used in the construction of the selections?); **Recyclability** (Do the selections contain recycled content?); **Disassembly** (Can the selections be disassembled at the end of their useful life to recycle their materials?).

1.8.2. Make selections to the greatest extent possible of products that possess current McDonough Braungart Design Chemistry ([MBDC](#)) certification or other "third-party" certified Cradle to Cradle program, Forest Stewardship Council (FSC) certification, GREENGAURD certification or similar "third-party" certified products consisting of low-emitting materials.

#### 1.9. FURNITURE SYSTEMS

1.9.1. General.

Where appropriate, design furniture systems in open office areas. Coordinate style and color of furniture systems with other storage, seating, etc. in open office areas. Minimize the number of workstation typicals and the parts and pieces required for the design to assist in future reconfiguration and inventorying.

1.9.2. Connector Systems.

Specify a connector system that allows removal of a single panel or spine wall within a typical workstation configuration without requiring disassembly of the workstation or removal of adjacent panels. Specify connector system with tight connections and continuous visual seals. When Acoustical panels are used, provide connector system with continuous acoustical seals. Specify concealed clips, screws, and other construction elements, where possible.

1.9.3. Panels and Spine Walls



Specify panels and spine walls with hinged or removable covers that permit easy access to the raceway when required but are securely mounted and cannot be accidentally dislodged under normal conditions. Panels shall be capable of structurally supporting more than 1 fully loaded component per panel per side. Raceways are to be an integral part of the panel and must be able to support lay-in cabling and have a large capacity for electrical and IT. Do not thread cables through the frame.

#### 1.9.4. Electrical And Information/Technology (IT)

Design furniture with electrical systems that meets requirements of UL 1286 when powered panels are required and UL approved task lights that meet requirements of NFPA 70. Dependent on user requirements and Section 01 10 00, paragraph 3 requirements, it is recommended that workstation electrical and IT wiring entry come from the building walls to eliminate the use of power poles and access at the floor. Design electrical and IT systems that are easily accessed in the spine wall and panels without having to move return panels and components. Electrical and IT management will be easily accessible by removable wall covers which can be removed while workstation components are still attached. Specify connector system that has continuation of electrical and IT wiring within workstations and workstation to workstation.

#### 1.9.5. Pedestals

Specify pedestals that are interchangeable from left to right, and right to left, and retain pedestal locking system capability.

### 1.10. EXECUTIVE FURNITURE

1.10.1. Design for executive furniture in command areas, coordinate specific locations with Corps of Engineers Interior Designer. Use upgraded furniture, upholsteries and finishes in command suites. This includes but is not limited to wood casegoods, seating and tables. Select executive furniture casegoods from a single manufacturer and style line, to include workstations, credenzas, filing, and storage, etc.

1.10.2. Specify furniture with wood veneer finish (except worksurfaces) with mitered solid wood edge of same wood type. Provide worksurface plastic laminate that closely matches adjacent wood veneer. Other executive office furniture such as seating, tables, executive conference room furniture, etc. shall be compatible in style, finish and color with executive furniture casegoods.

#### 1.11. SEATING

##### 1.11.1. General

Specify appropriate chair casters and glides for the floor finish where the seating is located. Universal casters that are appropriate for both hard surface flooring and carpet are preferred. All seating shall support up to a minimum of 250 lbs.

##### 1.11.2. Desk and Guest Seating

Select ergonomic desk chairs with casters, non-upholstered adjustable arms, waterfall front, swivel, tilt, variable back lock, adjustable back height or adjustable lumbar support, pneumatic seat height adjustment, and padded, contoured upholstered seat and back. Desk and guest chair backs may be other than upholstered such as mesh fabric if it is ergonomically designed, forms to back and is comfortable. Depending on scale of desk chair provide seat pan forward and back adjustment to increase or decrease depth of seat pan. All desk chairs shall have an adjustable seat height range of 4 1/2", range to include 16 1/2"-20". Select guest chairs that are compatible in style, finish and color with the desk chairs.

##### 1.11.3. Conference Room Seating

At tables, select ergonomic conference seating with casters, non-upholstered arms, waterfall front, swivel, tilt, pneumatic seat height adjustment, and padded, contoured seat and back, unless otherwise noted. Select arm height and/or design that allows seating to be moved up closely to the table top. Conference chair backs may be other than upholstered such as mesh fabric if it is ergonomically designed, forms to back and is comfortable. Perimeter conference chairs shall be compatible in style, finish and color with conference seating at the tables.

#### 1.11.4. Lounge, Waiting and Reception Area Seating

Select seating with arms and cushioned, upholstered seat and back. In heavy use areas, arms shall be easily cleaned such as non-upholstered arms or upholstered arms with wood arm caps unless otherwise noted.

#### 1.11.5. Break Room Seating

Select stackable seating that is easily cleaned. Seating shall be appropriate for table and counter heights as applicable with non-upholstered arms if arms are required. Chairs shall have metal legs and composite materials for seats.

#### 1.11.6. Lounge, Waiting and Reception Furniture.

Design for end and coffee tables with plastic laminate tops that are compatible in style finish and color with the seating.

#### 1.12. FILING AND STORAGE.

Select storage and shelving units that meet customer's functional load requirements for stored items. Specify counterweights for filing cabinets when required by the manufacturer for stability. File drawers shall allow only one drawer to be opened at a time. Provide heavy duty storage and shelving if information is not available.

#### 1.13. TRAINING TABLES.

Don't use plastic laminate self edge. Training tables shall be reconfigurable, moveable and storable; lighter weight folding with dollies or casters as necessary. Specify dollies if required.

#### 1.14. FURNITURE WARRANTIES.

Specify manufacturer's performance guarantees or warranties that include parts, labor and transportation as follows:

Furniture System, unless otherwise noted – 10 year minimum  
Furniture System Task Lights – 2 year minimum, excluding bulbs  
Furniture System Fabric – 3 year minimum  
Desks - 10 year minimum  
Seating, unless otherwise noted - 10 year minimum  
Seating Mechanisms and Pneumatic Cylinders - 10 years  
Fabric - 3 years minimum  
Filing and Storage - 10 year minimum  
Tables, unless otherwise noted - 10 year minimum  
Table Mechanisms – 5 year  
Table Ganging Device - 1 year  
Items not listed above - 1 year minimum

## **ATTACHMENT C**

### **TRACKING COMMENTS IN DRCHECKS**

#### **1.0 General**

The Government and DB Contractor shall set up the project in Dr Checks. Throughout the design process, the parties shall enter, track, and back-check comments using the DrChecks system. Government reviewers enter design review comments into DrChecks. Designers of Record shall annotate comments timely and specifically to indicate exactly what action will be taken or why the action is not required. Comments considered critical by the conference participants shall be flagged as such.

#### **2.0 DrChecks Review Comments**

The Contractor and the Government shall monitor DrChecks to assure all comments are annotated and agreed to by the designers and reviewers prior to the next submittal. The DrChecks comments and responses shall be printed and included in the design analysis for record.

2.1. Conference participants (reviewers) will expect coordination between Design Analysis calculations and the submitted design. Reviewers will also focus on the design submittal's satisfaction of the contract requirements.

2.2. The Designers of Record shall answer each comment in DrChecks with a formal response prior to the next submittal, clearly indicating what action will be taken and what drawing/spec will change. Designers of Record are encouraged to directly contact reviewers to discuss and agree to the formal comment responses rather than relying only on DrChecks and review meetings to discuss comments. With the next design conference, reviewers will back-check answers to the comments against the submittal, in addition to reviewing additional design work.

2.3. Comments that, in the DB Contractor's opinion, require effort outside the scope of the contract shall be clearly indicated as such in DrChecks. The DB Contractor shall not proceed with work outside the contract until a modification to the contract is properly executed, if one is necessary.

#### **3.0 DrChecks Initial Account Set-Up**

To initialize an office's use of DrChecks, choose a contact person within the office to call the DrChecks Help Desk at 800-428-HELP, M-F, 8AM-5PM, Central time. This POC will be given an office password to distribute to others in the office. Individuals can then go to the hyperlink at <http://www.projnet.org> and register as a first time user. Upon registration, each user will be given a personal password to the DrChecks system.

3.1. Once the office and individuals are registered, the COE's project manager or lead reviewer will assign the individuals and/or offices to the specific project for review. At this point, persons assigned can make comments, annotate comments, and close comments, depending on their particular assignment.

#### **4.0 DrChecks Reviewer Role**

The Contractor is the technical reviewer and the Government is the compliance reviewer of the DB designers design documents. Each reviewer enters their own comments into the Dr Checks system. To enter comments:

4.1. Log into DrChecks.

4.2. Click on the appropriate project.

4.3. Click on the appropriate review conference. An Add comment screen will appear.

4.4. Select or fill out the appropriate sections (particularly comment discipline and type of document for sorting) of the comment form and enter the comment in the space provided.

4.5. Click the Add Comment button. The comment will be added to the database and a fresh screen will appear for the next comment you have.

4.6. Once comments are all entered, exit DrChecks by choosing “My Account” and then Logout.

## **5.0 DrChecks Comment Evaluation**

The role of the designers of record is to evaluate and respond to the comments entered by the Government reviewers and by the DB Contractor. To respond to comments:

5.1. Log into DrChecks.

5.2. Click on the appropriate project.

5.3. Under “Evaluate” click on the number under “Pending”.

5.4. Locate the comments that require your evaluation. (Note: If you know the comment number you can use the Quick Pick window on your home page in DrChecks; enter the number and click on go.)

5.5. Select the appropriate evaluation (concur, non-concur, for information only, or check and resolve) and add the response.

5.6. Click on the Add button. The evaluation will be added to the database and a fresh screen will appear with the next comment.

5.7. Once evaluations are all entered, exit DrChecks by choosing “My Account” and then Logout.

## **6.0 DrChecks Back-check**

At the following design conference, participants will back-check comment annotations against newly presented documents to verify that the designers' responses are acceptable and completed. The Contractor and Government reviewers shall either enter additional back-check comments, as necessary or close those that are resolved as a result of the design conferences:

6.1. Log into DrChecks.

6.2. Click on the appropriate project.

6.3. Under “My Backcheck” click on the number under “Pending”.

6.4. If you agree with the designer's response select “Close Comment” and add a closing response if desired.

6.5. If you do not agree with the designer's response or the submittal does not reflect the response given, select “Issue Open”, enter additional information.

6.6. Click on the Add button. The back-check will be added to the database and a fresh screen will appear with the next comment.

6.7. Once back-checks are all entered, exit DrChecks by choosing “My Account” and then Logout. The design is completed and final when there are no pending comments to be evaluated and there are no pending or open comments under back-check.

**ATTACHMENT D**  
**SAMPLE FIRE PROTECTION AND LIFE SAFETY CODE REVIEW**

Instructions: Use the information outlined in this document to provide the minimum requirement for development of Fire Protection and Life Safety Code submittals for all building projects. Additional and supplemental information may be used to further develop the code review. Insert N/A after criteria, which may be "not applicable".

**1.0 SAMPLE FIRE PROTECTION AND LIFE SAFETY CODE REVIEW**

- 1.1. Project Name (insert name and location)
- 1.2. Applicable Codes and Standards
  - 1.2.1. Unified Facilities Criteria (UFC): 3-600-01, Design: Fire Protection Engineering For Facilities
  - 1.2.2. International Building Code (IBC) for fire resistance requirements, allowable floor area, building height limitations and building separation distance requirements, except as modified by UFC 3-600-01.
  - 1.2.3. National Fire Protection Association (NFPA) 101 Life Safety Code (latest edition), for building egress and life safety and applicable criteria in UFC 3-600-01.
  - 1.2.4. ADA and ABA Accessibility Guidelines. For Buildings and Facilities See Section 01 10 00, Paragraph 3 for facility specific criteria.
- 1.3. Occupancy Classification  
IBC chapters 3 and 4
- 1.4. Construction Type  
IBC chapter 6
- 1.5. Area Limitations  
IBC chapter 5, table 503
- 1.6. Allowable Floor Areas  
IBC section 503, 505
- 1.7. Allowable area increases  
IBC section 506, 507
- 1.8. Maximum Height of Buildings  
IBC section 504
- 1.9. Fire-resistive substitution
- 1.10. Occupancy Separations  
IBC table 302.3.2
- 1.11. Fire Resistive Requirements
  - 1.11.1. Exterior Walls - [ ] hour rating, IBC table 601, 602
  - 1.11.2. Interior Bearing walls - [ ] hour rating
  - 1.11.3. Structural frame - [ ] hour rating
  - 1.11.4. Permanent partitions - [ ] hour rating

- 1.11.5. Shaft enclosures - [ ] hour rating
- 1.11.6. Floors & Floor-Ceilings - [ ] hour rating
- 1.11.7. Roofs and Roof Ceilings - [ ] hour rating
- 1.12. Automatic Sprinklers and others used to determine the need for automatic Extinguishing Equipment, Extinguishing Systems, Foam Systems, Standpipe
  - 1.12.1. UFC 3-600-01, chapters 4 and 6 systems, wet chemical systems, etc. State which systems are required and to what criteria they will be designed.
  - 1.12.2. UFC 3-600-01, Appendix B Occupancy Classification. Note the classification for each room. This may be accomplished by classifying the entire building and noting exceptions for rooms that differ (E.g. The entire building is Light Hazard except boiler room and storage rooms which are [ ], etc.)
  - 1.12.3. UFC 3-600-01, Chapter 3 Sprinkler Design Density, Sprinkler Design Area, Water Demand for Hose Streams (supply pressure and source requirements).
  - 1.12.4. UFC 3-600-01, Chapter 4 Coverage per sprinkler head. Extended coverage sprinkler heads are not permitted.
  - 1.12.5. Available Water Supply. Provide the results of the water flow tests showing the available water supply static pressure and residual pressure at flow. Based on this data and the estimated flow and pressure required for the sprinkler system, determine the need for a fire pump.
  - 1.12.6. NFPA 13, Para. 8.16.4.6.1. Provide backflow preventer valves as required by the local municipality, authority, or water purveyor. Provide a test valve located downstream of the backflow preventer for flow testing the backflow preventer at full system demand flow. Route the discharge to an appropriate location outside the building.
- 1.13. Kitchen Cooking Exhaust Equipment  
Describe when kitchen cooking exhaust equipment is provided for the project. Type of extinguishing systems for the equipment should be provided. per NFPA 96. Show all interlocks with manual release switches, fuel shutoff valves, electrical shunt trips, exhaust fans, and building alarms.
- 1.14. Portable Fire Extinguishers, fire classification and travel distance. per NFPA 10
- 1.15. Enclosure Protection and Penetration Requirements. - Opening Protectives and Through Penetrations
  - 1.15.1. IBC Section 712, 715 and Table 715.3. Mechanical rooms, exit stairways, storage rooms, janitor [ ] hour rating. IBC Table 302.1.1
  - 1.15.2. Fire Blocks, Draft Stops, Through Penetrations and Opening Protectives
- 1.16. Fire Dampers. Describe where fire dampers and smoke dampers are to be used (IBC Section 716 and NFPA 90A). State whether isolation smoke dampers are required at the air handler.
- 1.17. Detection Alarm and Communication. UFC 3-600-01, (Chapter 5); NFPA 101 para. 3.4 (chapters 12-42); NFPA 72
- 1.18. Mass Notification. Describe building/facility mass notification system (UFC 4-021-01) type and type of base-wide mass notification/communication system. State whether the visible notification appliances will be combined with the fire alarm system or kept separate. (Note: Navy has taken position to combine visible notification appliances with fire alarm).
- 1.19. Interior Finishes (classification). NFPA 101.10.2.3 and NFPA 101.7.1.4
- 1.20. Means of Egress

- 1.20.1. Separation of Means of Egress, NFPA 101 chapters 7 and 12-42; NFPA101.7.1.3
- 1.20.2. Occupant Load, NFPA101.7.3.1 and chapters 12-42.
- 1.20.3. Egress Capacity (stairs, corridors, ramps and doors) NFPA101.7.3.3
- 1.20.4. Number of Means of Egress, NFPA101.7.4 and chapters 12-42.
- 1.20.5. Dead end limits and Common Path of Travel, NFPA 101.7.5.1.6 and chapters 12-42.
- 1.20.6. Accessible Means of Egress (for accessible buildings), NFPA101.7.5.4
- 1.20.7. Measurement of Travel Distance to Exits, NFPA101.7.6 and chapters 12-42.
- 1.20.8. Discharge from Exits, NFPA101.7.7.2
- 1.20.9. Illumination of Means of Egress, NFPA101.7.8
- 1.20.10. Emergency Lighting, NFPA101.7.9
- 1.20.11. Marking of Means of Egress, NFPA101.7.10
- 1.21. Elevators, UFC 3-600-01, Chapter 6; IBC and ASME A17.1 - 2000,(Safety Code for Elevators and Escalators)
- 1.22. Accessibility Requirements, ADA and ABA Accessibility Guidelines for Buildings and Facilities
- 1.23. Certification of Fire Protection and Life Safety Code Requirements. (Note: Edit the Fire team membership if necessary). Preparers of this document certify the accuracy and completeness of the Fire Protection and Life Safety features for this project in accordance with the attached completed form(s).
- 1.24. Designer of Record. Certification of Fire protection and Life Safety Code Requirements. (Note: Edit the Fire team members if necessary). Preparers of this document certify the accuracy and completeness of the Fire Protection and Life Safety features of this project.

Fire Protection Engineer of Record:

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Signature and Stamp

Date

OR

Architect of Record:

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Signature and Stamp

Date

Mechanical Engineer of Record:

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Signature and Stamp

Date

Electrical Engineer of Record:

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Signature/Date



**ATTACHMENT E**  
**LEED SUBMITTALS**

LEED Credit Paragraph	Contractor Check Here if Credit is Claimed	LEED-NC v3 Submittals (OCT09)	Provide for Credit Audit Only	REQUIRED DOCUMENTATION	Date Submitted (to be filled in by Contractor)	Government Reviewer's Use
PAR		FEATURE	DUE AT		DATE	REV
<b>GENERAL</b>						
GENERAL - All calculations shall be in accordance with LEED 2009 Reference Guide.						
GENERAL: Obtain excel version of this spreadsheet at <a href="http://en.sas.usace.army.mil/enWeb/EngineeringCriteria">http://en.sas.usace.army.mil/enWeb/EngineeringCriteria</a> .						
GENERAL - For all credits, narrative/comments may be added to describe special circumstances or considerations regarding the project's credit approach.						
GENERAL - Include all required LEED drawings indicated below in contract drawings with applicable discipline drawings, labeled For Reference Only.						
NOTE: Each submittal indicated with "****" differs from LEED certified project submittals by either having a different due date or being an added submittal not required by GBCI.						
NOTE: Projects seeking LEED certification need only submit to GBCI whatever documentation is acceptable to GBCI (for example, licensed professional certifications). This checklist identifies what must be submitted to the Government for internal review purposes. Government review of LEED documentation in no way supercedes or modifies the requirements and rulings of GBCI for purposes of compliance with project requirement to obtain LEED certification.						
GENERAL - Audit documentation may include but is not limited to what is indicated in this table.						
			Closeout	List of all Final Design submittals revised after final design to reflect actual closeout conditions. Revised Final Design submittals. - OR - Statement confirming that no changes have been made since final design that effect final design submittal documents.		Proj Engr (PE)
<b>CATEGORY 1 - SUSTAINABLE SITES</b>						
SSPR1		Construction Activity Pollution Prevention (PREREQUISITE)	**Final Design	List of drawings and specifications that address the erosion control, particulate/dust control and sedimentation control measures to be implemented.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			**Final Design	Narrative that indicates which compliance path was used (NPDES or Local standards) and describes the measures to be implemented on the project. If a local standard was followed, provide specific information to demonstrate that the local standard is equal to or more stringent than the NPDES program.		CIV
SS1		Site Selection	Final Design	Statement confirming that project does not meet any of the prohibited criteria.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design	LEED Site plan drawing that shows all proposed development, line depicting boundary of all bodies of water and/or wetlands within 100 feet of project boundary and a line depicting 5' elevation above 100 year flood line that falls within project boundary. Not required if neither condition applies.		CIV
SS2		Development Density & Community Connectivity	Final Design	Option 1: LEED Site vicinity plan showing project site and surrounding development. Show density boundary or note drawing scale.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design	Option 1: Table indicating, for project site and all surrounding sites within density radius (keyed to site vicinity plan), site area and building area. Project development density calculation. Density radius calculation. Development density calculation within density radius.		CIV
			Final Design	Option 2: LEED Site vicinity plan showing project site, the 1/2 mile community radius, pedestrian walkways and the locations of the residential development(s) and Basic Services surrounding the project site.		CIV
			Final Design	Option 2: List (including business name and type) of all Basic Services facilities within the 1/2 mile radius, keyed to site vicinity plan.		CIV
SS3		Brownfield Redevelopment	Final Design	Narrative describing contamination and the remediation activities included in project. Include statement indicating how site was determined to be a brownfield.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
SS4.1		Alternative Transportation: Public Transportation Access	Final Design	Statement indicating which option for compliance applies. State whether public transportation is existing or proposed and, if proposed, cite source of this information.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design	Option 1: LEED Site vicinity plan showing project site, mass transit stops and pedestrian path to them with path distance noted.		CIV
			Final Design	Option 2: LEED Site vicinity plan showing project site, bus stops and pedestrian path to them with path distance noted.		CIV
SS4.2		Alternative Transportation: Bicycle Storage & Changing Rooms	Final Design	FTE calculation. Bicycle storage spaces calculation. Shower/changing facilities calculation.		CIV
			Final Design	List of drawings that show the location(s) of bicycle storage areas. Statement indicating distance from building entrance.		CIV
			Final Design	List of drawings that show the location(s) of shower/changing facilities and, if located outside the building, statement indicating distance from building entrance.		CIV

Friday, June 18, 2010

LEED Credit Paragraph	Contractor Check Here if Credit is Claimed	LEED-NC v3 Submittals (OCT09)	Provide for Credit Audit Only		Date Submitted (to be filled in by Contractor)	Government Reviewer's Use
PAR		FEATURE	DUE AT	REQUIRED DOCUMENTATION	DATE	REV
SS4.3		Alternative Transportation: Low Emitting & Fuel Efficient Vehicles	Final Design	Statement indicating which option for compliance applies. FTE calculation. Statement indicating total parking capacity of site.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design	Option 1: Low-emission & fuel-efficient vehicle calculation.		CIV
			Final Design	Option 1: List of drawings and specification references that show location and number of preferred parking spaces for low-emission & fuel-efficient vehicles and signage.		CIV
			Final Design	Option 1: Statement indicating quantity, make, model and manufacturer of low-emission & fuel-efficient vehicles to be provided. Statement confirming vehicles are zero-emission or indicating ACEEE vehicle scores.		CIV
			Final Design	Option 2: Low-emission & fuel-efficient vehicle parking calculation.		CIV
			Final Design	Option 2: List of drawings and specification references that show location and number of preferred parking spaces and signage.		CIV
			Final Design	Option 3: Low-emission & fuel-efficient vehicle refueling station calculation.		CIV
			Final Design	Option 3: List of drawings and specifications indicating location and number of refueling stations, fuel type and fueling capacity for each station for an 8-hour period.		CIV
			Closeout	Option 3: Construction product submittals indicating what was provided and confirming compliance with respect to fuel type and fueling capacity for each station for an 8-hour period.		CIV
SS4.4		Alternative Transportation: Parking Capacity	Final Design	Statement indicating which option for compliance applies.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design	Option 1: Preferred parking calculation including number of spaces required, total provided, preferred spaces provided and percentage.		CIV
			Final Design	Option 2: FTE calculation. Preferred parking calculation including number of spaces provided, preferred spaces provided and percentage.		CIV
			Final Design	Options 1 and 2: List of drawings and specification references that show location and number of preferred parking spaces and signage.		CIV
			Final Design	Option 3: Narrative indicating number of spaces required and provided and describing infrastructure and support programs with description of project features to support them.		CIV
SS5.1		Site Development: Protect or Restore Habitat	**Final Design	Option 1: List of drawing and specification references that convey site disturbance limits.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			**Final Design	Option 2: LEED site plan drawing that delineates boundaries of each preserved and restored habitat area with area (sf) noted for each.		CIV
			**Final Design	Option 2: Percentage calculation of restored/preserved habitat to total site area. List of drawings and specification references that convey restoration planting requirements.		CIV
SS5.2		Site Development: Maximize Open Space	Final Design	Option 2: LEED site plan drawing delineating boundary of vegetated open space adjacent to building with areas of building footprint and designated open space noted.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
SS6.1		Stormwater Design: Quantity Control	Final Design	Statement indicating which option for compliance applies.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design	Option 1: Indicate pre-development and post-development runoff rate(cfs) and runoff quantity (cf) -OR- Narrative describing site conditions, measures and controls to be implemented to prevent excessive stream velocities and erosion.		CIV
			Final Design	Option 2: Indicate pre-development and post-development runoff rate(cfs) and runoff quantity (cf). Indicate percent reduction in each.		CIV
SS6.2		Stormwater Design: Quality Control	Final Design	For non-structural controls, list all BMPs used and, for each, describe the function of the BMP and indicate the percent annual rainfall treated. List all structural controls and, for each, describe the pollutant removal and indicate the percent annual rainfall treated.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
SS7.1		Heat Island Effect: Non-Roof	**Final Design	LEED site plan drawing indicating locations and quantities of each paving type, including areas of shaded pavement. Percentage calculation indicating percentage of reflective/shaded/open grid area.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV

Friday, June 18, 2010

LEED Credit Paragraph	Contractor Check Here if Credit is Claimed	LEED-NC v3 Submittals (OCT09)	Provide for Credit Audit Only		Date Submitted (to be filled in by Contractor)	Government Reviewer's Use
PAR		FEATURE	DUE AT	REQUIRED DOCUMENTATION	DATE	REV
SS7.2		Heat Island Effect: Roof	Final Design	Option 1: Percentage calculation indicating percentage of SRI compliant roof area. List of drawings and specification references that convey SRI requirements and roof slopes.		ARC
			Final Design	Option 1: List of specified roof materials indicating, for each, type, manufacturer, product name and identification if known, SRI value and roof slope.		ARC
			**Closeout	Option 1: List of installed roof materials indicating, for each, manufacturer, product name and identification, SRI value and roof slope.		PE
			Closeout	X Option 1: Manufacturer published product data or certification confirming SRI		PE
			Final Design	Option 2: Percentage calculation indicating percentage of vegetated roof area.		ARC
			Final Design	Option 3: Combined reflective and green roof calculation.		ARC
			Final Design	Option 3: List of specified roof materials indicating, for each, type, manufacturer, product name and identification if known, SRI value and roof slope.		ARC
			**Closeout	Option 3: List of installed roof materials indicating, for each, manufacturer, product name and identification, SRI value and roof slope.		PE
			Closeout	X Option 3: Manufacturer published product data or certification confirming SRI		PE
SS8		Light Pollution Reduction	Final Design	Interior Lighting: List of drawings and specification references that convey interior lighting requirements (location and type of all installed interior lighting, location of non-opaque exterior envelope surfaces, allowing confirmation that maximum candela value from interior fixtures does not intersect non-opaque building envelope surfaces). - OR - List of drawings and specification references that show automatic lighting controls compliance with credit requirement.		ELEC
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		ELEC
			Final Design	Exterior Lighting: List of drawings and specification references that convey exterior lighting requirements (location and type of all site lighting and building façade/landscape lighting).		ELEC
			Final Design	Exterior Site Lighting Power Density (LPD): Tabulation for exterior site lighting indicating, for each location identification or description, units of measure, area or distance of the location, actual LPD using units consistent with ASHRAE 90.1, and the ASHRAE allowable LPD for that type of location. Percentage calculation of actual versus allowable LPD for all site lighting.		ELEC
			Final Design	Exterior Building Facade/Landscape Lighting Power Density (LPD): Tabulation for exterior building facade/landscape lighting indicating, for each location identification or description, units of measure, area or distance of the location, actual LPD using units consistent with ASHRAE 90.1, and the ASHRAE allowable LPD for that type of location. Percentage calculation of actual versus allowable LPD for all building facade/landscape lighting.		ELEC
			Final Design	Exterior Lighting IESNA Zone: Indicate which IESNA zone is applicable to the project.		ELEC
			Final Design	Exterior Lighting Site Lumen table indicating, for each fixture type, quantity installed, initial lamp lumens per luminaire, initial lamp lumens above 90 degrees from Nadir, total lamp lumens and total lamp lumens above 90 degrees. Percentage of site lamp lumens above 90 degrees from nadir to total lamp lumens.		ELEC
			Final Design	Exterior Lighting Narrative describing analysis used for addressing requirements for light trespass at site boundary and beyond.		ELEC
<b>CATEGORY 2 – WATER EFFICIENCY</b>						
WEPR1		Water Use Reduction: 20% Reduction	Final Design	Statement confirming which occupancy breakdown applies (default or special). For special occupancy breakdown, indicate source and explanation for ratio.		MEC
			Final Design	Occupancy calculation including male/female numbers for FTEs, visitors, students, customers, residential and other type occupants/users		MEC
			Final Design	Statement indicating percent of male restrooms with urinals. Statement indicating annual days of operation.		MEC

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			Final Design	Baseline flush fixture calculation spreadsheet indicating, for each fixture type, gender, flush rate, daily uses per person for each occupant type identified in occupancy calculation and annual baseline flush fixture water usage.		MEC
			Final Design	Design case flush fixture calculation spreadsheet indicating, for each fixture type, gender, fixture manufacturer, fixture model number, flush rate, percent of occupants using this fixture type, daily uses per person for each occupant type identified in occupancy calculation and annual design case flush fixture water usage.		MEC
			Closeout	X Manufacturer published product data or certification confirming fixture water usage.		PE
WE1.1		Water Efficient Landscaping: Reduce by 50%	Final Design	Statement indicating which option for compliance applies.		CIV
			**Final Design	Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design	Calculation indicating, for baseline and design case, total water applied, total potable water applied, total non-potable water applied. Design case percent potable water reduction. If nonpotable water is used, indicate source of nonpotable water.		CIV
			Final Design	List of landscape plan drawings.		CIV
			Final Design	Narrative describing landscaping and irrigation design strategies, including water use calculation methodology used to determine savings and, if non-potable water is used, specific information about source and available quantity.		CIV
WE1.2		Water Efficient Landscaping: No Potable Water Use or No Irrigation	Same as WE1.1	Same as WE1.1		CIV
WE2		Innovative Wastewater Technologies	Final Design	Statement confirming which option for compliance applies.		MEC
			Final Design	Statement confirming which occupancy breakdown applies (default or special). For special occupancy breakdown, indicate source and explanation for ratio.		MEC
			Final Design	Occupancy calculation including male/female numbers for FTEs, visitors, students, customers, residential and other type occupants/users		MEC
			Final Design	Statement indicating percent of male restrooms with urinals. Statement indicating annual days of operation.		MEC
			Final Design	Baseline flush fixture calculation spreadsheet indicating, for each fixture type, gender, flush rate, daily uses per person for each occupant type identified in occupancy calculation and annual baseline flush fixture water usage.		MEC
			Final Design	Design case flush fixture calculation spreadsheet indicating, for each fixture type, gender, fixture manufacturer, fixture model number, flush rate, percent of occupants using this fixture type, daily uses per person for each occupant type identified in occupancy calculation and annual design case flush fixture water usage.		MEC
			Final Design	Option 1: If onsite non-potable water is used, identify source(s), indicate annual quantity from each source and indicate total annual quantity from all onsite non-potable water sources.		MEC
			Final Design	Option 1: Summary calculation indicating baseline annual water consumption, design case annual water consumption, non-potable annual water consumption and total percentage annual water savings.		MEC
			Final Design	Option 2: Statement confirming on-site treatment of all generated wastewater to tertiary standards and all treated wastewater is either infiltrated or used on-site.		MEC
			Final Design	Option 2: List of drawing and specification references that convey design of on-site wastewater treatment features.		CIV
			Final Design	Option 2: On-site water treatment quantity calculation indicating all on-site wastewater source(s), annual quantity treated, annual quantity infiltrated and annual quantity re-used on site from each source and totals for annual quantity treated, annual quantity infiltrated and annual quantity re-used on site from all sources.		CIV
			Final Design	Option 2: Wastewater summary calculation indicating design case annual flush fixture water usage, annual on-site water treatment and percentage sewage conveyance reduction.		MEC
			Final Design	Narrative describing project strategy for reduction of potable water use for sewage conveyance, including specific information on reclaimed water usage and treated wastewater usage.		MEC
WE3		Water Use Reduction: 30% - 40% Reduction	Same as WEPR1	Same as WEPR1		MEC

## CATEGORY 3 – ENERGY AND ATMOSPHERE

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EAPR1		Fundamental Commissioning of the Building Energy Systems (PREREQUISITE)	**Final Design	**Owner's Project Requirements document		ALL
			**Final Design	**Basis of Design document for commissioned systems		MEC, ELEC
			**Final Design	**Commissioning Plan		MEC, ELEC
			Closeout	Statement confirming all commissioning requirements have been incorporated into construction documents.		PE
			Closeout	Commissioning Report		PE
EAPR2		Minimum Energy Performance (PREREQUISITE)	Final Design	Statement listing the mandatory provisions of ASHRAE 90.1 that project meets relative to compliance with this prerequisite and indicating which compliance path was used.		MEC ELEC ARC
			Final Design	Statement indicating which compliance path option applies.		MEC
			Final Design	Option 1: Statement confirming simulation software capabilities and confirming assumptions and methodology.		MEC
			Final Design	Option 1: General information including simulation program, principal heating source, percent new construction and renovation, weather file, climate zone and Energy Star Target Finder score.		MEC
			Final Design	Option 1: Space summary listing, for each building use, the conditioned area, unconditioned area and total area and include total area for each category		MEC
			Final Design	Option 1: List of all simulation output advisory message data and show difference between baseline and proposed design		MEC
			Final Design	Option 1: Comparison summary for energy model inputs including description of baseline and design case energy model inputs, showing both by element type		MEC
			Final Design	Option 1: Energy type summary listing, for each energy type, utility rate description, units of energy and units of demand		MEC
			Final Design	Option 1: Statement indicating whether project uses on-site renewable energy. If yes, list all sources and indicate, for each source, backup energy type, annual energy generated, rated capacity and renewable energy cost		MEC
			Final Design	Option 1: If analysis includes exceptional calculation methods, statement describing how exceptional calculation measure cost savings is determined		MEC
			Final Design	Option 1: If analysis includes exceptional calculation methods, for each exceptional calculation method indicate energy types and, for each energy type, annual energy savings, annual cost savings, and brief descriptive narrative		MEC
			Final Design	Option 1: Baseline performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand for all four orientations. For each orientation indicate total annual energy use for each orientation and total annual process energy use.		MEC
			Final Design	Option 1: Baseline energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost.		MEC
			Final Design	Option 1: Proposed Design performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand, baseline annual and peak energy demand and percent savings. Indicate total annual energy use and total annual process energy use for both proposed design and baseline and percent savings.		MEC
			Final Design	Option 1: Proposed Design energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost.		MEC
			Final Design	Option 1: Energy cost and consumption by energy type report indicating, for each energy type, proposed design and baseline annual use and annual cost, percent savings annual use and annual cost. Indicate for renewable energy annual energy generated and annual cost. Indicate exceptional calculations annual energy savings and annual cost savings. Indicate building total annual energy use, annual energy cost for proposed design and baseline and indicate percent savings annual energy use and annual energy cost.		MEC

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			Final Design	Option 1: Compliance summaries from energy simulation software. If software does not produce compliance summaries provide output summaries and example input summaries for baseline and proposed design supporting data in the tables. Output summaries must include simulated energy consumption by end use and total energy use and cost by energy type. Example input summaries should represent most common systems and must include occupancy, use pattern, assumed envelope component sizes and descriptive features and assumed mechanical equipment types and descriptive features		MEC
			Final Design	Option 1: Energy rate tariff from project energy providers (only if not using LEED Reference Guide default rates)		MEC
EAPR3		Fundamental Refrigerant Management (PREREQUISITE)	Final Design	Statement indicating which option for compliance applies.		MEC
			Final Design	Option 2: Narrative describing phase out plan, including specific information on phase out dates and refrigerant quantities.		MEC
EA1		Optimize Energy Performance	Final Design	Statement indicating which compliance path option applies.		MEC
			Final Design	Option 1: Statement confirming simulation software capabilities and confirming assumptions and methodology.		MEC
			Final Design	Option 1: General information including simulation program, principal heating source, percent new construction and renovation, weather file, climate zone and Energy Star Target Finder score.		MEC
			Final Design	Option 1: Space summary listing, for each building use, the conditioned area, unconditioned area and total area and include total area for each category		MEC
			Final Design	Option 1: List of all simulation output advisory message data and show difference between baseline and proposed design		MEC
			Final Design	Option 1: Comparison summary for energy model inputs including description of baseline and design case energy model inputs, showing both by element type		MEC
			Final Design	Option 1: Energy type summary listing, for each energy type, utility rate description, units of energy and units of demand		MEC
			Final Design	Option 1: Statement indicating whether project uses on-site renewable energy. If yes, list all sources and indicate, for each source, backup energy type, annual energy generated, rated capacity and renewable energy cost		MEC
			Final Design	Option 1: If analysis includes exceptional calculation methods, statement describing how exceptional calculation measure cost savings is determined		MEC
			Final Design	Option 1: If analysis includes exceptional calculation methods, for each exceptional calculation method indicate energy types and, for each energy type, annual energy savings, annual cost savings, and brief descriptive narrative		MEC
			Final Design	Option 1: Baseline performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand for all four orientations. For each orientation indicate total annual energy use for each orientation and total annual process energy use.		MEC
			Final Design	Option 1: Baseline energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost.		MEC
			Final Design	Option 1: Proposed Design performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand, baseline annual and peak energy demand and percent savings. Indicate total annual energy use and total annual process energy use for both proposed design and baseline and percent savings.		MEC
			Final Design	Option 1: Proposed Design energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost.		MEC
			Final Design	Option 1: Energy cost and consumption by energy type report indicating, for each energy type, proposed design and baseline annual use and annual cost, percent savings annual use and annual cost. Indicate for renewable energy annual energy generated and annual cost. Indicate exceptional calculations annual energy savings and annual cost savings. Indicate building total annual energy use, annual energy cost for proposed design and baseline and indicate percent savings annual energy use and annual energy cost.		MEC

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			Final Design	Option 1: Compliance summaries from energy simulation software. If software does not produce compliance summaries provide output summaries and example input summaries for baseline and proposed design supporting data in the tables. Output summaries must include simulated energy consumption by end use and total energy use and cost by energy type. Example input summaries should represent most common systems and must include occupancy, use pattern, assumed envelope component sizes and descriptive features and assumed mechanical equipment types and descriptive features	MEC
			Final Design	Option 1: Energy rate tariff from project energy providers (only if not using LEED Reference Guide default rates)	MEC
EA2.1		On-Site Renewable Energy	Final Design	Statement indicating which compliance path option applies.	ELEC
			Final Design	List all on-site renewable energy sources and indicate, for each source, backup energy type, annual energy generated, rated capacity and renewable energy cost. Indicate total annual energy use (all sources), total annual energy cost (all sources) and percent renewable energy cost.	ELEC MEC
			Final Design	Option 1: Indicate, for renewable energy, proposed design total annual energy generated and annual cost.	ELEC MEC
			Final Design	Option 2: Indicate CBECS building type and building gross area. Provide the following CBECS data: median annual electrical intensity, median annual non-electrical fuel intensity, average electric energy cost, average non-electric fuel cost, annual electric energy use and cost, annual non-electric fuel use and cost.	ELEC MEC
			Final Design	Option 2: Narrative describing renewable systems and explaining calculation method used to estimate annual energy generated, including factors influencing performance.	ELEC MEC
EA2.2		On-Site Renewable Energy	Same as EA2.1	Same as EA2.1	ELEC MEC
EA2.3		On-Site Renewable Energy	Same as EA2.1	Same as EA2.1	ELEC MEC
EA3		Enhanced Commissioning	**Final Design	**Owner's Project Requirements document (OPR)	ALL
			**Final Design	**Basis of Design document for commissioned systems (BOD)	ELEC MEC
			**Final Design	**Commissioning Plan	ELEC MEC
			Closeout	Statement confirming all commissioning requirements have been incorporated into construction documents.	PE
			Closeout	**Commissioning Report	PE
			**Final Design	Statement by CxA confirming Commissioning Design Review	
			Closeout	Statement by CxA confirming review of Contractor submittals for compliance with OPR and BOD	PE
			Closeout	**Systems Manual	PE
			Closeout	Statement by CxA confirming completion of O&M staff and occupant training	PE
			Closeout	**Scope of work for post-occupancy review of building operation, including plan for resolution of outstanding issues	PE
			**Predesign	Statement confirming CxA qualifications and contractual relationships relative to work on this project, demonstrating that CxA is an independent third party.	MEC
EA4		Enhanced Refrigerant Management	Final Design	Refrigerant impact calculation table with all building data and calculation values as shown in LEED 2009 Reference Guide Example Calculations	MEC
			Final Design	Narrative describing any special circumstances or explanatory remarks	
			Closeout	X Cut sheets highlighting refrigerant data for all HVAC components.	PE
EA5		Measurement & Verification	Closeout	Statement indicating which compliance path option applies.	PE
			Closeout	Measurement and Verification Plan including Corrective Action Plan	PE
			Closeout	**Scope of work for post-occupancy implementation of M&V plan including corrective action plan.	PE
EA6		Green Power	Closeout	Statement indicating which compliance path option applies.	PE
			Closeout	Option 1: Indicate proposed design total annual electric energy usage	PE
			Closeout	Option 2: Indicate actual total annual electric energy usage	PE
			Closeout	Option 3: Calculation indicating building type, total gross area, median electrical intensity and annual electric energy use	PE

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			Closeout	Green power provider summary table indicating, for each purchase type, provider name, annual quantity green power purchased and contract term. Indicate total annual green power use and indicate percent green power		PE
			Closeout	Narrative describing how Green Power or Green Tags are purchased		PE
<b>CATEGORY 4 – MATERIALS AND RESOURCES</b>						
MRPR1		Storage & Collection of Recyclables (PREREQUISITE)	Final Design	Statement confirming that recycling area will accommodate recycling of plastic, metal, paper, cardboard and glass. Narrative indicating any other materials addressed and coordination with pickup.		ARC
MR1.1		Building Reuse: Maintain 55% of Existing Walls, Floors & Roof	**Final Design	If project includes a building addition, confirm that area of building addition does not exceed 2x the area of the existing building.		ARC
			**Final Design	Spreadsheet listing, for each building structural/envelope element, the existing area and reused area. Total percent reused.		ARC
MR1.2		Building Reuse: Maintain 75% of Existing Walls, Floors & Roof	Same as MR1.1	Same as MR1.1		ARC
MR1.3		Building Reuse: Maintain 95% of Existing Walls, Floors & Roof	Same as MR1.1	Same as MR1.1		ARC
MR1.4		Building Reuse: Maintain 50% of Interior Non-Structural Elements	**Final Design	If project includes a building addition, confirm that area of building addition does not exceed 2x the area of the existing building.		ARC
			**Final Design	Spreadsheet listing, for each building interior non-structural element, the existing area and reused area. Total percent reused.		ARC
MR2.1		Construction Waste Management: Divert 50% From Disposal	**Preconstruction	Waste Management Plan		PE
			**Construction Quarterly and Closeout	Spreadsheet calculations indicating material description, disposal/diversion location (or recycling hauler), weight, total waste generated, total waste diverted, diversion percentage		PE
			**Construction Quarterly and Closeout	Receipts/tickets for all items on spreadsheet		PE
MR2.2		Construction Waste Management: Divert 75% From Disposal	Same as MR2.1	Same as MR2.1		PE
MR3.1		Materials Reuse: 5%	Closeout	Statement indicating total materials value and whether default or actual.		PE
			Closeout	Spreadsheet calculations indicating, for each reused/salvaged material, material description, source or vendor, cost. Total reused/salvaged materials percentage.		PE
MR3.2		Materials Reuse: 10%	Same as MR3.1	Same as MR3.1		PE
MR4.1		Recycled Content: 10% (post-consumer + 1/2 pre-consumer)	Closeout	Statement indicating total materials value and whether default or actual.		PE
			Closeout	Spreadsheet calculations indicating, for each recycled content material, material name/description, manufacturer, cost, post-consumer recycled content percent, pre-consumer recycled content percent, source of recycled content data. Total post-consumer content materials cost, total pre-consumer content materials cost, total combined recycled content materials cost, recycled content materials percentage.		PE
			Final Design or NLT Preconstruction	**Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal.		PE
			Closeout	Manufacturer published product data or certification, confirming recycled content percentages in spreadsheet		PE
MR4.2		Recycled Content: 20% (post-consumer + 1/2 pre-consumer)	Same as MR4.1	Same as MR4.1		PE
MR5.1		Regional Materials: 10% Extracted, Processed & Manufactured Regionally	Closeout	Statement indicating total materials value and whether default or actual.		PE
			Closeout	Spreadsheet calculations indicating, for each regional material, material name/description, manufacturer, cost, percent compliant, harvest distance, manufacture distance, source of manufacture and harvest location data. Total regional materials cost, regional materials percentage.		PE
			Preconstruction	**Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal.		PE
			Closeout	Manufacturer published product data or certification confirming regional material percentages in spreadsheet		PE

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MR5.2		Regional Materials:20% Extracted, Processed & Manufactured Regionally	Same as MR5.1		Same as MR5.1		PE	
MR6		Rapidly Renewable Materials	Closeout		Statement indicating total materials value and whether default or actual.		PE	
			Closeout		Spreadsheet calculations indicating, for each rapidly renewable material, material name/description, manufacturer, cost, rapidly renewable content percent, rapidly renewable product value. Total rapidly renewable product value, rapidly renewable materials percentage.		PE	
			Final Design		**Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal.		ARC	
			Closeout	X	Manufacturer published product data or certification confirming rapidly renewable material percentages in spreadsheet		PE	
MR7		Certified Wood	Closeout		Statement indicating total materials value and whether default or actual.		PE	
			Closeout		Spreadsheet calculations indicating, for each certified wood material, material name/description, vendor, cost, wood component percent, certified wood percent of wood component, FSC chain of custody certificate number. Total certified wood product value, certified wood materials percentage.		PE	
			Final Design or NLT Preconstruction		**Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal.		PE	
			Closeout	X	Vendor invoices, FSC chain of custody certificates and anufacturer published product data or certification confirming all certified wood materials percentages in spreadsheet.		PE	
INDOOR ENVIRONMENTAL QUALITY								
EQPR1		Minimum IAQ Performance (PREREQUISITE)	Final Design		Statement indicating which option for compliance applies, stating applicable criteria/requirement, and confirming that project has been designed to meet the applicable requirements.		MEC	
			Final Design		Narrative describing the project's ventilation design, including specifics about fresh air intake volumes and special considerations.		MEC	
EQPR2		Environmental Tobacco Smoke (ETS) Control (PREREQUISITE)	Final Design		Statement indicating which option for compliance applies, stating applicable criteria/requirement, and confirming that project has been designed to meet the applicable requirements.		ARC	
			Final Design		List of drawing and specification references that convey conformance to applicable requirements (signage, exhaust system, room separation details, etc).		ARC	
EQ1		Outdoor Air Delivery Monitoring	Final Design		Statement indicating which option for compliance applies and confirming that project has been designed to meet the applicable requirements.		MEC	
			Final Design		List of drawing and specification references that convey conformance to applicable requirements.		MEC	
			Final Design		Narrative describing the project's ventilation design and CO2 monitoring system, including specifics about monitors, operational parameters and setpoints.		MEC	
			Closeout	X	Cut sheets for CO2 monitoring system.		PE	
EQ2		Increased Ventilation	Final Design		Statement indicating which option for compliance applies and confirming that project has been designed to meet the applicable requirements.		MEC	
			Final Design		Narrative describing the project's ventilation design, including specifics about zone fresh air intake volumes and demonstrating compliance.		MEC	
			Final Design		Option 2: Narrative describing design method used for determining natural ventilation design, including calculation methodology/model results and demonstrating compliance.		MEC	
			Final Design		List of drawing and specification references that convey conformance to applicable requirements.		MEC	
EQ3.1		Construction IAQ Management Plan: During Construction	**Preconstruction		Construction IAQ Management Plan		PE	
			Closeout		Statement confirming whether air handling units were operated during construction		PE	
			Closeout		Dated jobsite photos showing examples of IAQ management plan practices being implemented. Label photos to indicate which practice they demonstrate. Minimum one photo of each practice at each building.		PE	

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			Closeout	Spreadsheet indicating, for each filter installed during construction, the manufacturer, model number, MERV rating, location installed, and if it was replaced immediately prior to occupancy.		PE
EQ3.2		Construction IAQ Management Plan: Before Occupancy	**Preconstruction	Construction IAQ Management Plan		PE
			Closeout	Statement indicating which option for compliance applies and confirming that required activities have occurred that meet the applicable requirements.		PE
			Closeout	Option 1a: Narrative describing the project's flushout process, including specifics about temperature, airflow and duration, special considerations (if any) and demonstrating compliance.		PE
			Closeout	Option 1b: Narrative describing the project's pre-occupancy and post-occupancy flushout processes, including specifics about temperature, airflow and duration, special considerations (if any) and demonstrating compliance.		PE
			Closeout	Option 2: Narrative describing the project's IAQ testing process, including specifics about contaminants tested for, locations, remaining work at time of test, retest parameters and special considerations (if any).		PE
			Closeout	Option 2: IAQ testing report demonstrating compliance.		PE
EQ4.1		Low Emitting Materials: Adhesives & Sealants	Closeout	Spreadsheet indicating, for each applicable indoor adhesive, sealant and sealant primer used, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data.		PE
			Closeout	Spreadsheet indicating, for each applicable indoor aerosol adhesive, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data - OR - Statement confirming no indoor aerosol adhesives were used for the project.		PE
			Closeout	Manufacturer published product data or certification confirming material VOCs in spreadsheet		PE
EQ4.2		Low Emitting Materials: Paints & Coatings	Closeout	Spreadsheet indicating, for each applicable indoor paint and coating used, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data.		PE
			Closeout	Spreadsheet indicating, for each applicable indoor anti-corrosive/anti-rust paint and coating used, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data - OR - Statement confirming no indoor anti-corrosive/anti-rust paints were used for the project.		PE
			Closeout	Manufacturer published product data or certification confirming material VOCs in spreadsheet		PE
EQ4.3		Low Emitting Materials: Flooring Systems	Closeout	Spreadsheet indicating, for each indoor flooring system used, the manufacturer, product name/model number, if it meets LEED requirement (yes/no) and source of LEED compliance data.		PE
			Closeout	Spreadsheet indicating, for each indoor carpet cushion used, the manufacturer, product name/model number, if it meets LEED requirement (yes/no) and source of LEED compliance data - OR - Statement confirming no indoor carpet cushion was used for the project.		PE
			Closeout	Manufacturer published product data or certification confirming material compliance label in spreadsheet		PE
EQ4.4		Low Emitting Materials: Composite Wood & Agrifiber Products	Closeout	Spreadsheet indicating, for each indoor composite wood and agrifiber product used, the manufacturer, product name/model number, if it contains added urea formaldehyde (yes/no) and source of LEED compliance data.		PE
			Closeout	Manufacturer published product data or certification confirming material urea formaldehyde in spreadsheet		PE
EQ5		Indoor Chemical & Pollutant Source Control	Closeout	Spreadsheet indicating, for each permanent entryway system used, the manufacturer, product name/model number and description of system.		PE
			Final Design	List of drawing and specification references that convey locations and installation methods for entryway systems.		ARC
			Final Design	Spreadsheet indicating, for each chemical use area, the room number, room name, description of room separation features (walls, floor/ceilings, openings) and pressure differential from surrounding spaces with doors closed - OR - Statement confirming that project includes no chemical use areas and that no hazardous cleaning materials are needed for building maintenance.		ARC MEC
			Final Design	If project includes chemical use areas: List of drawing and specification references that convey locations of chemical use areas, room separation features and exhaust system.		ARC

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			Final Design	If project includes places where water and chemical concentrate mixing occurs: List of drawing and specification references that convey provisions for containment of hazardous liquid wastes OR - Statement confirming that project includes no places where water and chemical concentrate mixing occurs.	ARC MEC
			Closeout	If project includes chemical use areas: Spreadsheet indicating, for AHUs/mechanical ventilation equipment serving occupied areas, the manufacturer, model number, MERV rating, location installed, and if it was replaced immediately prior to occupancy (yes/no) - OR - Statement confirming that project does not use mechanical equipment for ventilation of occupied areas.	PE
EQ6.1		Controllability of Systems: Lighting	Final Design	Calculation indicating total number of individual workstations, number of workstations with individual lighting controls and the percentage of workstations with individual lighting controls.	ELEC
			Final Design	For each shared multi-occupant space, provide a brief description of lighting controls.	ELEC
			Final Design	Narrative describing lighting control strategy, including type and location of individual controls and type and location of controls in shared multi-occupant spaces.	ELEC
EQ6.2		Controllability of Systems: Thermal Comfort	Final Design	Calculation indicating total number of individual workstations, number of workstations with individual thermal comfort controls and the percentage of workstations with individual thermal comfort controls.	MEC
			Final Design	For each shared multi-occupant space, provide a brief description of thermal comfort controls.	MEC
			Final Design	Narrative describing thermal comfort control strategy, including type and location of individual and shared multi-occupant controls.	MEC
EQ7.1		Thermal Comfort: Design	Final Design	Design criteria spreadsheet indicating, for spring, summer, fall and winter, maximum indoor space design temperature, minimum indoor space design temperature and maximum indoor space design humidity.	MEC
			Final Design	Narrative describing method used to establish thermal comfort control conditions and how systems design addresses the design criteria, including compliance with the referenced standard.	MEC
EQ7.2		Thermal Comfort: Verification	Final Design	Narrative describing the scope of work for the thermal comfort survey, including corrective action plan development	MEC
			Final Design	List of drawing and specification references that convey permanent monitoring system.	MEC
EQ8.1		Daylight & Views: Daylight 75% of Spaces	Final Design	Option 2: Table indicating all regularly occupied spaces with space area and space area with compliant daylight zone. Sum of regularly occupied areas and regularly occupied areas with compliant daylight zone. Percentage calculation of areas with compliant daylight zone to total regularly occupied areas.	ARC
			Final Design	Option 1: Simulation model method, software and output data	ELEC
			Final Design	Option 1: Table indicating all regularly occupied spaces with space area, space area with minimum 25 footcandles daylighting illumination, and method of providing glare control. Sum of regularly occupied areas and regularly occupied areas with 25 fc daylighting. Percentage calculation of areas with 25 fc daylighting to total regularly occupied areas.	ELEC
			Final Design	For all occupied spaces excluded from the calculation, provide narrative indicating reasons for excluding the space.	ARC
			Final Design	List of drawing and specification references that convey exterior glazed opening head and sill heights, glazing performance properties and glare control/sunlight redirection devices.	ARC
			Closeout	Manufacturer published product data or certification confirming glazing Tvis in spreadsheet	PE
EQ8.2		Daylight & Views: Views for 90% of Spaces	Final Design	Table indicating all regularly occupied spaces with space area and space area with access to views. Sum of regularly occupied areas and regularly occupied areas with access to views. Percentage calculation of areas with views to total regularly occupied areas.	ARC
			Final Design	For all occupied spaces excluded from the calculation, provide narrative indicating reasons for excluding the space.	ARC
			Final Design	LEED Floor plan drawings showing line of sight diagramming of views areas in each regularly occupied space. List of drawing/specification references that convey exterior glazed opening head and sill heights.	ARC
<b>INNOVATION &amp; DESIGN PROCESS</b>					

LEED Credit Paragraph	Contractor Check Here if Credit is Claimed	LEED-NC v3 Submittals (OCT09)		Provide for Credit Audit Only		Date Submitted (to be filled in by Contractor)	Government Reviewer's Use
PAR		FEATURE	DUE AT		REQUIRED DOCUMENTATION	DATE	REV
IDc1.1		Innovation in Design	Final Design		Narrative describing intent, requirement for credit, project approach to the credit. List of drawings and specification references that convey implementation of credit. All other documentation that validates claimed credit.		
IDc1.2		Innovation in Design	Final Design				
IDc1.3		Innovation in Design	Final Design				
IDc1.4		Innovation in Design	Final Design				
IDc2		LEED Accredited Professional	Final Design		Narrative indicating name of LEED AP, company name of LEED AP, description of LEED AP's role and responsibilities in the project.		ARC

**ATTACHMENT F**  
Version 02-03-2010

**BUILDING INFORMATION MODELING REQUIREMENTS**

**1.0 Section 1 - Submittal Format**

1.1. Design Deliverables. Develop all designs using Building Information Modeling (BIM) and Computer Aided Design (CAD) software. Design submittal drawings shall be Full size, suitable for half-size scaled reproduction.

**2.0 Section 2 – Design Requirements**

2.1. BIM Model and Facility Data. Contractor shall use BIM application(s) and software(s) to develop project designs. "Facility Data" is defined as associated intelligent attribute data. The "Model" is defined as 3D graphics that includes Facility Data and output as described in the paragraph 'Output' below. Contractors will use the Model to produce accurate Construction Documents. For each Center of Standardization (CoS) facility type included in this project, all BIM Models and associated Facility Data shall be submitted in Bentley Systems BIM V8i 08.11.07 with associated USACE Bentley BIM Workspace (which includes specific standard BIM libraries and definitions). This Workspace can be downloaded from the CAD/BIM Technology Center. [Where available, the workspace will be specific to this CoS Facility Standard Design. The Contractor will be provided a baseline multi-discipline BIM Project Model for the CoS Facility Standard Design type, where such a model exists (for the purposes of site adaptation).] The USACE Bentley BIM Workspace is dependent on specific versions of the Bentley BIM suite of products and only the versions of the software that are listed in the Contractor instructions included with the USACE BIM Workspace are permitted to be used.

2.1.1. Reference. Refer to ERDC TR-06-10, "U.S. Army Corps of Engineers Building Information Modeling Road Map" from the CAD/BIM Technology Center website for more information on the USACE BIM implementation goals.

2.2. Drawings. Deliver CAD files used for the creation of the Construction Documents Drawings per requirements in Section 01 33 16, the criteria of the USACE Omaha District, and as noted herein. Specification of a CAD file format for these Drawings does not limit which BIM application(s) or software(s) may be used for project development and execution.

2.2.1. IFC Support. The Contractor's selected BIM application(s) and software(s) must support the IFC (Industry Foundation Class - see [www.iai-tech.org](http://www.iai-tech.org)). Submit any deviations from or additions to the IFC property sets for any new spaces, systems, and equipment for Government approval.

2.2.2. Submittal Requirements. BIM submittals shall be fully interoperable, compatible, and editable with the Bentley BIM tools. Use the specified version of the USACE Bentley BIM Workspace and conform to the requirements of **Sections 3 and 4 below**.

2.2.3. BIM Project Execution Plan.

2.2.3.1. Develop a BIM Project Execution Plan ("Plan" or "PxP") documenting the BIM and analysis technologies selected for the Project Model (integrated with the AEC CAD Standard) from concept development through As-Builts as a design, production, coordination, construction, and documentation tool and the collaborative process by which it shall be executed. See Section 7 for additional guidance on developing the Plan.

2.2.4. BIM Requirements..

2.2.4.1. Facility Data. Develop the Facility Data consisting of a set of intelligent elements for the Model (e.g., doors, air handlers, electrical panels). This Facility Data shall include all material definitions and attributes that are necessary for the Project facility design and construction. Additional data in support of Section 6 Contractor Electives is encouraged.

2.2.4.2. Model Content. The Model and Facility Data shall include, at a minimum, the requirements of Section 4 below.

2.2.4.3. Model Granularity. Models may vary in level of detail for individual elements within a model, but at a minimum must include all features that would be included on a quarter inch (1/4" = 1'0") scaled drawing (e.g. at least 1/16<sup>th</sup>, 1/8<sup>th</sup> and 1/4<sup>th</sup>), or appropriately scaled civil drawings.

2.2.4.4. Output. Submitted CAD drawings (e.g., plans, elevations, sections, schedules, details, etc.) shall be derived (commonly known as extractions, views or sheets) and maintained from the submitted Model and Facility Data.

2.3. Quality Control. Implement quality control (QC) parameters for the Model, including:

2.3.1. Model Standards Checks. QC validation used to ensure that the Project Facility Data set has no undefined, incorrectly defined or duplicated elements. Report non-compliant elements and corrective action plan to correct non-compliant elements. Provide the government with detailed justification and request government approval for any non-compliant element which the contractor proposes to be allowed to remain in the Model.

2.3.2. CAD Standards Checks. QC checking performed to ensure that the fonts, dimensions, line styles, levels and other construction document formatting issues are followed per the A/E/C CADD Standard.

2.3.3. Other Parameters. Develop such other QC parameters as Contractor deems appropriate for the Project and provide to the Government for concurrence.

2.4. Design and Construction Reviews. Perform design and construction reviews at each submittal stage under Section 3 to test the Model, including:

2.4.1. Visual Checks. Checking to ensure the design intent has been followed and that there are no unintended elements in the Model.

2.4.2. Interference Management Checks. Locate conflicting spatial data in the Model where two elements are occupying the same space. Log hard interferences (e.g., mechanical vs. structural or mechanical vs. mechanical overlaps in the same location) and soft interferences, (e.g., conflicts regarding equipment clearance, service access, fireproofing, insulation) in a written report and resolve.

2.4.3. IFC Coordination View. Provide an IFC Coordination View in IFC Express format for all deliverables. Provide exported property set data for all IFC supported named building elements.

2.4.4. Other Parameters. Develop such other Review parameters as the Contractor deems appropriate for the Project and provide to the Government for concurrence..

### **3.0 Section 3 – Design Stage Submittal Requirements**

3.1. General Submittal Requirements.

3.1.1. Provide submittals in compliance with BIM Project Execution Plan deliverables at stages as described hereinafter.

3.1.2. At each Stage in Paragraphs 3.3 through 3.6, provide a Contractor-certified written report confirming that consistency checks as identified in Paragraphs 2.3 and 2.4 have been completed. This report shall be discussed as part of the review process and shall address cross-discipline interferences, if any.

3.1.3. At each Stage in Paragraphs 3.3 through 3.6, provide the Government with:

- The Model, Facility Data, Workspace and CAD Data files in native Bentley BIM/CAD.

- A 3-D interactive review format of the Model in Bentley Navigator, Autodesk Navisworks, Adobe 3D PDF 7.0 (or later), Google Earth KMZ or other format per Plan requirements. The file format for reviews can change between submittals.

- A list of all submitted files. The list should include a description, directory, and file name for each file submitted. For all CAD sheets, include the sheet title and sheet number. Identify files that have been produced from the submitted Model and Facility Data.

### 3.2. Initial Design Conference Submittal.

3.2.1. Submit a digital copy of the Plan where, in addition to Paragraph 3.1.4, the USACE Geographic District BIM Manager will coordinate with the USACE CoS BIM Manager to confirm acceptability of the Plan or advise as to additional processes or activities necessary to be incorporated.

3.2.2. Within thirty (30) days after the approval of the Plan, conduct a demonstration to review the Plan for clarification, and to verify the functionality of Model technology workflow and processes. If modifications are required, the Contractor shall complete the modifications and resubmit the Plan and perform subsequent demonstration for Government acceptance. There will be no payment for design or construction until the Plan is acceptable to the Government. The Government may also withhold payment for design and construction for unacceptable performance in executing the approved Plan.

### 3.3. Interim Design Submittals.

3.3.1. BIM and CAD Data. The Model shall include the requirements identified in Paragraph 2.2.4 as applicable to the Interim Design package(s).

### 3.4. Final Design Submissions and Design Complete Submittals.

3.4.1. BIM and CAD Data. The Model shall include the requirements identified in Paragraph 2.2.4. Acceptance according to Paragraph 3.1.4 is required before commencement of construction, as described in Paragraph 3.7.6 of Section 01 33 16.

3.5. Construction Submittals – Over-The-Shoulder Progress Reviews. Periodic quality control meetings or construction progress review meetings shall include quality control reviews on the implementation and use of the Model, including interference management and design change tracking information.

3.6. Final As-Built BIM and CAD Data Submittal. Submit the final Model, Facility Data, and CAD files reflecting as-built conditions for Government Approval, as specified in Section 01 78 02.00 10, PROJECT CLOSEOUT.

## 4.0 **Section 4 – BIM Model Minimum Requirements and Output**

4.1. General Provisions. The deliverable Model shall be developed to include the systems described below as they would be built and the processes of installing them, and to reflect final as-built conditions. The deliverable model at the interim design stage and at the final design stage (“released for construction”) shall be developed to include as many of the systems described below as are necessary and appropriate at that design stage.

4.2. Architectural/Interior Design. The Architectural systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4”=1’0”) scaled drawing. Additional minimum Model requirements include:

4.2.1. Spaces. The Model shall include spaces defining accurate net square footage and net volume, and holding data for the room finish schedule for including room names and numbers. Include Programmatic Information provided by the Government or validated program to verify design space against programmed space, using this information to validate area quantities.

4.2.2. Walls and Curtain Walls. Each wall shall be depicted to the exact height, length, width and ratings (thermal, acoustic, fire) to properly reflect wall types. The Model shall include all walls, both interior and exterior, and the necessary intelligence to produce accurate plans, sections and elevations depicting these design elements.

4.2.3. Doors, Windows and Louvers. Doors, windows and louvers shall be depicted to represent their actual size, type and location. Doors and windows shall be modeled with the necessary intelligence to produce accurate window and door schedules.



4.2.4. Roof. The Model shall include the roof configuration, drainage system, penetrations, specialties, and the necessary intelligence to produce accurate plans, building sections and generic wall sections where roof design elements are depicted.

4.2.5. Floors. The floor slab shall be developed in the structural Model and then referenced by the architectural Model for each floor of the Project building.

4.2.6. Ceilings. All heights and other dimensions of ceilings, including soffits, ceiling materials, or other special conditions shall be depicted in the Model with the necessary intelligence to produce accurate plans, building sections and generic wall sections where ceiling design elements are depicted.

4.2.7. Vertical Circulation. All continuous vertical components (i.e., non-structural shafts, architectural stairs, handrails and guardrails) shall be accurately depicted and shall include the necessary intelligence to produce accurate plans, elevations and sections in which such design elements are referenced.

4.2.8. Architectural Specialties and Woodwork. All architectural specialties (i.e., toilet room accessories, toilet partitions, grab bars, lockers, and display cases) and woodwork (i.e., cabinetry and counters) shall be accurately depicted with the necessary intelligence to produce accurate plans, elevations and sections in which such design elements are referenced.

4.2.9. Signage. The Model shall include all signage and the necessary intelligence to produce accurate plans and schedules.

4.2.10. Schedules. Provide door, window, hardware sets using BHMA designations, flooring, wall finish, and signage schedules from the Model, indicating the type, materials and finishes used in the design.

4.3. Furniture. The furniture systems Model may vary in level of detail for individual elements within a Model, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing, and have necessary intelligence to produce accurate plans. Representation of furniture elements is to be 2D. Contractor may provide a minimal number of 3D representations as examples. Examples of furniture include, but are not limited to, desks, furniture systems, seating, tables, and office storage.

4.3.1. Furniture Coordination. Furniture that makes use of electrical, data or other features shall include the necessary intelligence to produce coordinated documents and data.

4.4. Equipment. The Model may vary in level of detail for individual elements within a Model. Equipment shall be depicted to meet layout requirements with the necessary intelligence to produce accurate plans and minimum schedules depicting their configuration. Examples of equipment include but are not limited to copiers, printers, refrigerators, ice machines and microwaves.

4.4.1. Schedules. Provide furniture and equipment schedules from the model indicating the materials, finishes, mechanical, and electrical requirements.

4.5. Structural. The structural systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Additional minimum Model requirements include:

4.5.1. Foundations. All necessary foundation and/or footing elements, with necessary intelligence to produce accurate plans and elevations

4.5.2. Floor Slabs. Structural floor slabs shall be depicted, including all necessary recesses, curbs, pads, closure pours, and major penetrations accurately depicted.

4.5.3. Structural Steel. All steel columns, primary and secondary framing members, and steel bracing for the roof and floor systems (including decks), including all necessary intelligence to produce accurate structural steel framing plans and related building/wall sections.

4.5.4. Cast-in-Place Concrete. All walls, columns, and beams, including necessary intelligence to produce accurate plans and building/wall sections depicting cast-in-place concrete elements.

4.5.5. Expansion/Contraction Joints. Joints shall be accurately depicted.

4.5.6. Stairs. The structural Model shall include all necessary openings and framing members for stair systems, including necessary intelligence to produce accurate plans and building/wall sections depicting stair design elements.

4.5.7. Shafts and Pits. The structural Model shall include all necessary shafts, pits, and openings, including necessary intelligence to produce accurate plans and building/wall sections depicting these design elements.

4.6. Mechanical. The mechanical systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Small diameter (less than 1-1/2" NPS) field-routed piping is not required in the model. Additional minimum Model requirements include:

4.6.1. HVAC. All necessary heating, ventilating, air-conditioning and specialty equipment, including air distribution ducts for supply, return, and ventilation and exhaust ducts, including control system, registers, diffusers, grills and hydronic baseboards with necessary intelligence to produce accurate plans, elevations, building/wall sections and schedules.

4.6.1.1. Mechanical Piping. All necessary piping and fixture layouts, and related equipment, including necessary intelligence to produce accurate plans, elevations, building/wall sections, and schedules.

4.6.2. Plumbing. All necessary plumbing piping and fixture layouts, floor and area drains, and related equipment, including necessary intelligence to produce accurate plans, elevations, building/wall sections, riser diagrams, and schedules.

4.6.3. Equipment Clearances. All HVAC and Plumbing equipment clearances shall be modeled for use in interference management and maintenance access requirements.

4.6.4. Elevator Equipment. The Model shall include the necessary equipment and control system, including necessary intelligence to produce accurate plans, sections and elevations depicting these design elements.

4.7. Electrical/Telecommunications. The electrical systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Small diameter (less than 1-1/2"Ø) field-routed conduit is not required in the model. Additional minimum Model requirements include:

4.7.1. Interior Electrical Power and Lighting. All necessary interior electrical components (i.e., lighting, receptacles, special and general purpose power receptacles, lighting fixtures, panelboards, cable trays and control systems), including necessary intelligence to produce accurate plans, details and schedules. Lighting and power built into furniture/equipment shall be modeled.

4.7.2. Special Electrical Systems. All necessary special electrical components (i.e., security, Mass Notification, Public Address, nurse call and other special occupancies, and control systems), including necessary intelligence to produce accurate plans, details and schedules.

4.7.3. Grounding Systems. Grounding Systems. All necessary grounding components (i.e., lightning protection systems, static grounding systems, communications grounding systems, bonding), including necessary intelligence to produce accurate plans, details and schedules.

4.7.4. Communications. All existing and new communications service controls and connections, both above ground and underground with necessary intelligence to produce accurate plans, details and schedules. Cable tray routing shall be modeled without detail of cable contents.

4.7.5. Exterior Building Lighting. All necessary exterior lighting with necessary intelligence to produce accurate plans, elevations and schedules. The exterior building lighting Model shall include all necessary lighting, relevant existing and proposed support utility lines and equipment required with necessary intelligence to produce accurate plans, details and schedules.

4.7.6. Equipment Clearances. The model shall incorporate and define all electrical and communications working spaces, clearances, and required access

4.8. Fire Protection. The fire protection system Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Additional minimum Model requirements include:

4.8.1. Fire Protection System. All relevant fire protection components (i.e., branch piping, sprinkler heads, fittings, drains, pumps, tanks, sensors, control panels) with necessary intelligence to produce accurate plans, elevations, building/wall sections, riser diagrams, and schedules. All fire protection piping shall be modeled.

4.8.2. Fire Alarms. Fire alarm/mass notification devices and detection system shall be indicated with necessary intelligence to produce accurate plans depicting them.

4.9. Civil. The civil Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a one inch (1"=100') scaled drawing. Additional minimum Model requirements include:

4.9.1. Terrain (DTM). All relevant site conditions and proposed grading, including necessary intelligence to produce accurate Project site topographical plans and cross sections.

4.9.2. Drainage. All existing and new drainage piping, including upgrades thereto, including necessary intelligence to produce accurate plans and profiles for the Project site.

4.9.3. Storm Water and Sanitary Sewers. All existing and new sewer structures and piping, including upgrades thereto, on the Project site with necessary connections to mains or other distribution points as appropriate, including necessary intelligence to produce accurate plans and profiles for the Project site.

4.9.4. Utilities. All necessary new utilities connections from the Project building(s) to the existing or newly-created utilities, and all existing above ground and underground utility conduits, including necessary intelligence to produce accurate plans and site-sections.

4.9.5. Roads and Parking. All necessary roadways and parking lots or parking structures, including necessary intelligence to produce accurate plans, profiles and cross-sections.

## **5.0 Section 5 - Ownership and Rights in Data**

5.1. Ownership. The Government has ownership of and rights at the date of Closeout Submittal to all CAD files, BIM Model, and Facility Data developed for the Project in accordance with FAR Part 27, clauses incorporated in Section 00 72 00, Contract Clauses and Special Contract Requirement 1.14 GOVERNMENT RE-USE OF DESIGN (Section 00 73 00). The Government may make use of this data following any deliverable.

## **6.0 Section 6 – Contractor Electives**

6.1. Applicable Criteria. If the Contractor elected to include one or more of the following features as an elective in its accepted contract proposal for additional credit during the source selection, as described in the proposal submission requirements and evaluation criteria, the following criteria are requirements, as applicable to those elective feature(s).

6.2. COBIE Compliance. The Model and Facility Data for the Project shall fulfill Construction Operations Building Information Exchange (COBIE) requirements as defined by the Whole Building Design Guide organization, including all requirements for the indexing and submission of Portable Document Format (PDF) and other appropriate file formats that would otherwise be printed and submitted in compliance with Project operations and maintenance handover requirements.

6.3. Project Scheduling using the Model. In the BIM Execution Plan and during the Preliminary BIM Execution Plan Review, provide an overview of the use of BIM in the development and support of the project construction schedule.

6.3.1. Submittal Requirements. During the Submittal stages, the Contractor shall deliver the construction schedule with information derived from the Model.

6.3.1.1. Construction Submittals – Over-The-Shoulder Progress Reviews. Periodic quality control meetings or construction progress review meetings shall include quality control reviews on the implementation and use of the Model for project scheduling.

6.4. Cost Estimating. In the BIM Execution Plan and during the Preliminary BIM Execution Plan Review, provide an overview of the use of BIM in the development and support of cost estimating requirements, or other applications such as cost analysis and estimate validation.

6.4.1. Submittal Requirements. During the Submittal stages, the Contractor shall deliver cost estimating information derived from the Model.

6.4.2. Project completion. At project completion, the Contractor shall provide an MII (Micro Computer Aided Cost Estimating System Generation II) Cost Estimate which follows the USACE Cost Engineering Military Work Breakdown System (WBS), a modified Uniformat, to at least the sub-systems level and uses quantity information supplied directly from BIM output to the maximum extent possible, though other "Gap" quantity information will be included as necessary for a complete and accurate cost estimate.

6.4.2.1. Sub system level extracted quantities from the BIM for use within the estimate shall be provided according to how detailed line items or tasks should be installed/built so that accurate costs can be developed and/or reflected. Therefore, when developing a BIM, the designer shall be cognizant of what tasks need to be separated appropriately at the beginning stages of model development, such as tasks done on the first floor versus the same task on higher floors that will be more labor intensive and therefore need to have a separate quantity and be priced differently. Tasks and their extracted quantities from the BIM shall be broken down by their location (proximity in the structure) as well as the complexity of its installation.

6.4.2.2. At all design stages it shall be understood that BIM output as described in this document will not generate all quantities that are necessary in order to develop a complete and accurate cost estimate of the project based on the design. An example of this would be plumbing that is less than 1.5" diameter and therefore not expected to be modeled due to granularity; this information is commonly referred to as The Gap. Quantities from The Gap and their associated costs shall be included in the final project actual cost estimates as well.

6.5. Other Analyses and Reports. Structural, energy and efficiency, EPACT 2005 & EISA 2007, lighting design, daylighting, electrical power, psychrometric processing, shading, programming, LEED, fire protection, code compliance, Life Cycle Cost, acoustic, plumbing.

## **7.0 Section 7 – BIM Project Execution Plan Template**

7.1. Contractors will utilize the latest version of the USACE BIM PROJECT EXECUTION PLAN (USACE PxP) Template to develop an acceptable Plan. The template can be downloaded from the CAD/BIM Technology Center website.





**ATTACHMENT G****DESIGN SUBMITTAL DIRECTORY AND SUBDIRECTORY FILE ARRANGEMENT**

Organize electronic design submittal files in a subdirectory/file structure in accordance with the following table. The Contractor may suggest a slightly different structure, subject to the discretion of the government.

**Design Submittal Directory and Subdirectory File Arrangement.**

Directory	Sub-Directory	Sub-Directory or Files	Files
Submittal/Package Name	Narratives	PDF file or files with updated design narrative for each applicable design discipline	
	Drawings	PDF (subdirectory)	Single PDF file with all applicable drawing sheets - bookmarked by sheet number and name
		BIM (subdirectory) See Attachment F.	BIM project folder (with files) per the USACE Workspace. Include an Excel drawing index file with each drawing sheet listed by sheet #, name and corresponding dgn file name (Final Design & Design Complete only)
	Design Analysis & Calculations	Individual PDF files containing design analysis and calculations for each discipline applicable to the submittal	
		PDF file with Fire Protection and Life Safety Code Review checklist	
	LEED	PDF file with updated Leed Check List	
		PDF file or files with LEED Templates for each point with applicable documentation included in each file.	
		LEED SUBMITTALS	
	Energy Analysis	PDF with baseline energy consumption analysis	
		PDF with actual building energy consumption analysis	
	Specifications	Single PDF file with table of contents and all applicable specifications sections.	
		Submittal Register (Final Design & Design Complete submittal only)	
	Design Quality Control	PDF file or files with DQC checklist(s) and/or statements	
	Building Rendering(s)	PDF file of rendering for each building type included in contract (Final Design & Design Complete).	

**SECTION 01 45 01.10**  
**QUALITY CONTROL SYSTEM (QCS)**

**1.0 GENERAL**

- 1.1. CORRESPONDENCE AND ELECTRONIC COMMUNICATIONS
- 1.2. QCS SOFTWARE
- 1.3. SYSTEM REQUIREMENTS
- 1.4. RELATED INFORMATION
- 1.5. CONTRACT DATABASE
- 1.6. DATABASE MAINTENANCE
- 1.7. IMPLEMENTATION
- 1.8. DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM
- 1.9. MONTHLY COORDINATION MEETING
- 1.10. NOTIFICATION OF NONCOMPLIANCE



## 1.0 GENERAL

The Government will use the Resident Management System for Windows (RMS) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS, referred to as QCS, to record, maintain, and submit various information throughout the contract period. The Contractor module, user manuals, updates, and training information can be downloaded from the RMS web site. This joint Government-Contractor use of RMS and QCS will facilitate electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

- Administration
- Finances
- Quality Control
- Submittal Monitoring
- Scheduling
- Import/Export of Data
- Request for Information
- Accident Reporting
- Safety Exposure Manhours

### 1.1. CORRESPONDENCE AND ELECTRONIC COMMUNICATIONS

For ease and speed of communications, both Government and Contractor will exchange correspondence and other documents in electronic format. Correspondence, pay requests and other documents comprising the official contract record shall also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

### 1.2. OTHER FACTORS

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", Section 01 32 01.00 10, PROJECT SCHEDULE, Section 01 33 00, SUBMITTAL PROCEDURES, and Section 01 45 04.00 10, CONTRACTOR QUALITY CONTROL, which have a direct relationship to the reporting to be accomplished through QCS. Also, there is no separate payment for establishing and maintaining the QCS database; all costs associated therewith shall be included in the contract pricing for the work.

### 1.3. QCS SOFTWARE

QCS is a Windows-based program that can be run on a stand-alone personal computer or on a network. The Government will make available the QCS software to the Contractor after award of the construction contract. Prior to the Pre-Construction Conference, the Contractor shall be responsible to download, install and use the latest version of the QCS software from the Government's RMS Internet Website. Upon specific justification and request by the Contractor, the Government can provide QCS on CD-ROM. Any program updates of QCS will be made available to the Contractor via the Government RMS Website as they become available.

### 1.4. SYSTEM REQUIREMENTS

The following listed hardware and software is the minimum system configuration that the Contractor shall have to run QCS:

#### (a) Hardware

- IBM-compatible PC with 1000 MHz Pentium or higher processor
- 256 MB RAM for workstation / 512+ MB RAM for server
- 1 GB hard drive disk space for sole use by the QCS system
- Compact disk (CD) Reader, 8x speed or higher
- SVGA or higher resolution monitor (1024 x 768, 256 colors)
- Mouse or other pointing device
- Windows compatible printer (Laser printer must have 4+ MB of RAM)
- Connection to the Internet, minimum 56K BPS

(b) Software

- MS Windows 2000 or higher
- MS Word 2000 or newer
- Latest version of : Netscape Navigator, Microsoft Internet Explorer, or other browser that supports HTML 4.0 or higher
- Electronic mail (E-mail), MAPI compatible
- Virus protection software that is regularly upgraded with all issued manufacturer's updates

1.5. RELATED INFORMATION

1.5.1. QCS USER GUIDE

After contract award, the Contractor shall download instructions for the installation and use of QCS from the Government RMS Internet Website. In case of justifiable difficulties, the Government will provide the Contractor with a CD-ROM containing these instructions.

1.5.2. CONTRACTOR QUALITY CONTROL (CQC) TRAINING

The use of QCS will be discussed with the Contractor's QC System Manager during the mandatory CQC Training class.

1.6. CONTRACT DATABASE

Prior to the pre-construction conference, the Government will provide the Contractor with basic contract award data to use for QCS. The Government will provide data updates to the Contractor as needed, generally by using the government's SFTP repository built into QCS import/export function. These updates will generally consist of submittal reviews, correspondence status, QA comments, and other administrative and QA data.

1.7. DATABASE MAINTENANCE

The Contractor shall establish, maintain, and update data for the contract in the QCS database throughout the duration of the contract. The Contractor shall establish and maintain the QCS database at the Contractor's site office. Data updates to the Government, e.g., daily reports, submittals, RFI's, schedule updates, payment requests, etc. shall be submitted using the government's SFTP repository built into QCS export function. If permitted by the Contracting Officer, email or CD-ROM may be used instead (see Paragraph DATA SUBMISSION VIA CD-ROM). The QCS database typically shall include current data on the following items:

1.7.1. ADMINISTRATION

1.7.1.1. Contractor Information

The database shall contain the Contractor's name, address, telephone numbers, management staff, and other required items. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver Contractor administrative data in electronic format.

1.7.1.2. Subcontractor Information

The database shall contain the name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor must be listed separately for each trade to be performed. Each subcontractor/trade shall be assigned a unique Responsibility Code, provided in QCS. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver subcontractor administrative data in electronic format.

1.7.1.3. Correspondence

All Contractor correspondence to the Government shall be identified with a serial number. Correspondence initiated by the Contractor's site office shall be prefixed with "S". Letters initiated by the Contractor's home (main)

office shall be prefixed with "H". Letters shall be numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C".

All Requests For Information (RFI) shall be exchanged using the Built-in RFI generator and tracker in QCS.

#### 1.7.1.4. Equipment

The Contractor's QCS database shall contain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

#### 1.7.1.5. Management Reporting

QCS includes a number of reports that Contractor management can use to track the status of the project. The value of these reports is reflective of the quality of the data input, and is maintained in the various sections of QCS. Among these reports are: Progress Payment Request worksheet, QA/QC comments, Submittal Register Status, Three-Phase Inspection checklists.

### 1.7.2. FINANCES

#### 1.7.2.1. Pay Activity Data

The QCS database shall include a list of pay activities that the Contractor shall develop in conjunction with the design and construction schedule. The sum of all pay activities shall be equal to the total contract amount, including modifications. Pay activities shall be grouped by Contract Line Item Number (CLIN), and the sum of the activities shall equal the amount of each CLIN. The total of all CLINs equals the Contract Amount.

#### 1.7.2.2. Payment Requests

All progress payment requests shall be prepared using QCS. The Contractor shall complete the payment request worksheet prompt payment certification, and payment invoice in QCS. The work completed under the contract, measured as percent or as specific quantities, shall be updated at least monthly. After the update, the Contractor shall generate a payment request report using QCS. The Contractor shall submit the payment request, prompt payment certification, and payment invoice with supporting data by using the government's SFTP repository built into QCS export function. If permitted by the Contracting Officer, E-mail or a CD-ROM may be used. A signed paper copy of the approved payment request is also required, which shall govern in the event of discrepancy with the electronic version.

#### 1.7.3. Quality Control (QC)

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other contractor QC requirements. The Contractor shall maintain this data on a daily basis. Entered data will automatically output to the QCS generated daily report. The Contractor shall provide the Government a Contractor Quality Control (CQC) Plan within the time required in Section 01 45 04.00 10, CONTRACTOR QUALITY CONTROL. Within seven calendar days of Government acceptance, the Contractor shall submit a QCS update reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

#### 1.7.3.1. Daily Contractor Quality Control (CQC) Reports

QCS includes the means to produce the Daily CQC Report. The Contractor may use other formats to record basic QC data. However, the Daily CQC Report generated by QCS shall be the Contractor's official report. Data from any supplemental reports by the Contractor shall be summarized and consolidated onto the QCS-generated Daily CQC Report. Daily CQC Reports shall be submitted as required by Section 01 45 04.00 10, CONTRACTOR QUALITY CONTROL. Reports shall be submitted electronically to the Government within 24 hours after the date covered by the report. The Contractor shall also provide the Government a signed, printed copy of the daily CQC report.

#### 1.7.3.2. Deficiency Tracking

The Contractor shall use QCS to track deficiencies. Deficiencies identified by the Contractor will be numerically tracked using QC punch list items. The Contractor shall maintain a current log of its QC punch list items in the QCS database. The Government will log the deficiencies it has identified using its QA punch list items. The Government's QA punch list items will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of both QC and QA punch list items.

#### 1.7.3.3. QC Requirements

The Contractor shall develop and maintain a complete list of QC testing and required structural and life safety special inspections required by the International Code Council (ICC), transferred and installed property, and user training requirements in QCS. The Contractor shall update all data on these QC requirements as work progresses, and shall promptly provide this information to the Government via QCS.

#### 1.7.3.4. Three-Phase Control Meetings

The Contractor shall maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

#### 1.7.3.5. Labor and Equipment Hours

The Contractor shall log labor and equipment exposure hours on a daily basis. This data will be rolled up into a monthly exposure report.

#### 1.7.3.6. Accident/Safety Tracking Reporting

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of the safety comments. In addition, the Contractor shall utilize QCS to advise the Government of any accidents occurring on the jobsite. This supplemental entry is not to be considered as a substitute for completion of mandatory notification and reports, e.g., ENG Form 3394 and OSHA Form 300.

#### 1.7.3.7. Features of Work

The Contractor shall include a complete list of the features of work in the QCS database. A feature of work may be associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

#### 1.7.3.8. Hazard Analysis

The Contractor shall use QCS to develop a hazard analysis for each feature of work included in its CQC Plan. The hazard analysis shall address any hazards, or potential hazards, that may be associated with the work

#### 1.7.4. Submittal Management

The Government will provide the submittal register form, ENG Form 4288, SUBMITTAL REGISTER, in electronic format. The Contractor and Designer of Record (DOR) shall develop and maintain a complete list of all submittals, including completion of all data columns and shall manage all submittals. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update, ENG Form 4288, shall be produced using QCS. QCS and RMS will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

#### 1.7.5. Schedule

The Contractor shall develop a design and construction schedule consisting of pay activities, in accordance with Section 01 32 01.00 10, PROJECT SCHEDULE, as applicable. This schedule shall be input and maintained in the QCS database either manually or by using the Standard Data Exchange Format (SDEF) (see Section 01 32 01.00 10 PROJECT SCHEDULE). The updated schedule data shall be included with each pay request submitted by the Contractor.

#### 1.7.5.1. Import/Export of Data

QCS includes the ability to export Contractor data to the Government and to import submittal register and other Government-provided data from RMS, and schedule data using SDEF.

#### 1.8. IMPLEMENTATION

Contractor use of QCS as described in the preceding paragraphs is mandatory. The Contractor shall ensure that sufficient resources are available to maintain its QCS database, and to provide the Government with regular database updates. QCS shall be an integral part of the Contractor's management of quality control.

#### 1.9. DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM

The Government-preferred method for Contractor's submission of QCS data is by using the government's SFTP repository built into QCS export function.. Other data should be submitted using E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of CD-ROM for data transfer. Data on CDs shall be exported using the QCS built-in export function. If used, CD-ROMs will be submitted in accordance with the following:

##### 1.9.1. File Medium

The Contractor shall submit required data on CD-ROMs. They shall conform to industry standards used in the United States. All data shall be provided in English.

##### 1.9.2. Disk Or Cd-Rom Labels

The Contractor shall affix a permanent exterior label to each diskette and CD-ROM submitted. The label shall indicate in English, the QCS file name, full contract number, contract name, project location, data date, name and telephone number of person responsible for the data.

##### 1.9.3. File Names

The files will be automatically named by the QCS software. The naming convention established by the QCS software shall not be altered in any way by the Contractor.

#### 1.10. MONTHLY COORDINATION MEETING

The Contractor shall update the QCS database each workday. At least monthly, the Contractor shall generate and submit an export file to the Government with schedule update and progress payment request. As required in Contract Clause "Payments", at least one week prior to submittal, the Contractor shall meet with the Government representative to review the planned progress payment data submission for errors and omissions.

The Contractor shall make all required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will be returned. The Government will not process progress payments until an acceptable QCS export file is received.

#### 1.11. NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification.

End of Section 01 45 01.10

**SECTION 01 45 04.00 10**  
**CONTRACTOR QUALITY CONTROL**

**1.0 GENERAL**

1.1. REFERENCES

1.2. PAYMENT

**2.0 PRODUCTS (NOT APPLICABLE)**

**3.0 EXECUTION**

3.1. GENERAL REQUIREMENTS

3.2. QUALITY CONTROL PLAN

3.3. COORDINATION MEETING

3.4. QUALITY CONTROL ORGANIZATION

3.5. SUBMITTALS AND DELIVERABLES

3.6. CONTROL

3.7. TESTS

3.8. COMPLETION INSPECTION

3.9. DOCUMENTATION

3.10. NOTIFICATION OF NONCOMPLIANCE

## **1.0 GENERAL**

### **1.1. REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. Refer to the latest edition, as of the date of the contract solicitation.

- ASTM INTERNATIONAL (ASTM)
- ASTM D 3740 Minimum Requirements for Agencies  
Engaged in the Testing and/or Inspection  
of Soil and Rock as Used in Engineering  
Design and Construction
- ASTM E 329 Agencies Engaged in the Testing  
and/or Inspection of Materials Used in  
Construction
- U.S. ARMY CORPS OF ENGINEERS (USACE)  
ER 1110-1-12 Quality Management

### **1.2. PAYMENT**

There will be no separate payment for providing and maintaining an effective Quality Control program. Include all costs associated therewith in the applicable unit prices or lump-sum prices contained in the Contract Line Item Schedule.

## **2.0 PRODUCTS (Not Applicable)**

## **3.0 EXECUTION**

### **3.1. GENERAL REQUIREMENTS**

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product, which complies with the contract requirements. The system shall cover all design and construction operations, both onsite and offsite, and shall be keyed to the proposed design and construction sequence. The site project superintendent is responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. The site project superintendent in this context shall be the highest level manager responsible for the overall construction activities at the site, including quality and production. The site project superintendent shall maintain a physical presence at the site at all times, except as otherwise acceptable to the Contracting Officer, and shall be responsible for all construction and construction related activities at the site.

### **3.2. QUALITY CONTROL PLAN**

Furnish for Government review, not later than 30 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Design and construction may begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. The Government will not permit work outside of the features of work included in an accepted interim plan to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started. Where the applicable Code issued by the International Code Council calls for an inspection by the Building Official, the Contractor shall include the inspections in the Quality Control Plan and shall perform the inspections. The Designer of Record shall develop a program for any special inspections required by the applicable International Codes and the Contractor shall perform these inspections, using qualified inspectors. Include the special inspection plan in the QC Plan.

### 3.2.1. Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all design and construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents subcontractors, designers of record, consultants, architect/engineers (AE), fabricators, suppliers, and purchasing agents:

3.2.1.1. A description of the quality control organization. Include a chart showing lines of authority and an acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. A CQC System Manager shall report to the project superintendent or someone higher in the contractor's organization.

3.2.1.2. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function. Also include those responsible for performing and documenting the inspections required by the International Codes and the special inspection program developed by the designer of record.

3.2.1.3. A copy of the letter to the CQC System Manager, signed by an authorized official of the firm, which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Furnish copies of these letters.

3.2.1.4. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents subcontractors, designers of record, consultants, architect engineers (AE), offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

3.2.1.5. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. Use only Government approved Laboratory facilities.

3.2.1.6. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

3.2.1.7. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.

3.2.1.8. Reporting procedures, including proposed reporting formats.

3.2.1.9. A list of the definable features of work. A definable feature of work is a task, which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the coordination meeting.

3.2.1.10. A list of all inspections required by the International Codes and the special inspection program required by the code and this contract.

### 3.2.2. Additional Requirements for Design Quality Control (DQC) Plan

The following additional requirements apply to the Design Quality Control (DQC) plan:

3.2.2.1. The Contractor's QCP Plan shall provide and maintain a Design Quality Control (DQC) Plan as an effective quality control program which will assure that all services required by this design-build contract are performed and provided in a manner that meets professional architectural and engineering quality standards. As a minimum, competent, independent reviewers identified in the DQC Plan shall review all documents. Use personnel who were not involved in the design effort to produce the design to perform the independent technical review (ITR). The ITR is intended as a quality control check of the design. Include, at least, but not necessarily limited to, a review of the contract requirements (the accepted contract or task order proposal and amended RFP), the basis of design, design calculations, the design configuration management documentation and check the design documents for



errors, omissions, and for coordination and design integration. The ITR team is not required to examine, compare or comment concerning alternate design solutions but should concentrate on ensuring that the design meets the contract requirements. Correct errors and deficiencies in the design documents prior to submitting them to the Government.

3.2.2.2. Include in the DQC Plan the discipline-specific checklists to be used during the design and quality control of each submittal. Submit these completed checklists at each design phase as part of the project documentation.

3.2.2.3. A Design Quality Control Manager, who has the responsibility of being cognizant of and assuring that all documents on the project have been coordinated, shall implement the DQC Plan. This individual shall be a person who has verifiable engineering or architectural design experience and is a registered professional engineer or architect. Notify the Government, in writing, of the name of the individual, and the name of an alternate person assigned to the position.

### 3.2.3. Acceptance of Plan

Government acceptance of the Contractor's plan is required prior to the start of design and construction. Acceptance is conditional and will be predicated on satisfactory performance during the design and construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

### 3.2.4. Notification of Changes

After acceptance of the CQC Plan, notify the Government in writing of any proposed change. Proposed changes are subject to Government acceptance.

## 3.3. COORDINATION MEETING

After the Postaward Conference, before start of design or construction, and prior to acceptance by the Government of the CQC Plan, the Contractor and the Government shall meet and discuss the Contractor's quality control system. Submit the CQC Plan for review a minimum of 7 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, design activities, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. The Government will prepare minutes of the meeting for signature by both parties. . The minutes shall become a part of the contract file. There may be occasions when either party will call for subsequent conferences to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

## 3.4. QUALITY CONTROL ORGANIZATION

### 3.4.1. Personnel Requirements

The requirements for the CQC organization are a CQC System Manager, a Design Quality Manager, and sufficient number of additional qualified personnel to ensure contract compliance. The CQC organization shall also include personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly. The Contractor's CQC staff shall maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff shall be subject to acceptance by the Contracting Officer. Provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly furnish complete records of all letters, material submittals, shop drawing submittals, schedules and all other project documentation to the CQC organization. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

### 3.4.2. CQC System Manager

Identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System

Manager shall be a graduate engineer, graduate architect, or a BA/BS graduate of an ACCE accredited construction management college program. The CQC system Manager may alternately be an engineering technician with at least 2 years of college and an ICC certification as a Commercial Building Inspector (Residential Building Inspector certification will be required for Military Family Housing projects). In addition, the CQC system manager shall have a minimum of 5 years construction experience on construction similar to this contract. The CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. Assign the CQC System Manager no other duties (except may also serve as Safety and Health Officer, if qualified and if allowed by Section 00 73 00). Identify an alternate for the CQC System Manager in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager but the alternate may have other duties in addition to serving in a temporary capacity as the acting QC manager.

### 3.4.3. CQC Personnel

3.4.3.1. In addition to CQC personnel specified elsewhere in the contract provide specialized CQC personnel to assist the CQC System Manager in accordance with paragraph titled Area Qualifications.

3.4.3.2. These individuals may be employees of the prime or subcontractor; be responsible to the CQC System Manager; **are not intended to be full time, but must be physically present at the construction site during work on their areas of responsibility**; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals may perform other duties but must be allowed sufficient time to perform their assigned quality control duties as described in the Quality Control Plan. **One person may cover more than one area, provided that they are qualified to perform QC activities for the designated areas below and provided that they have adequate time to perform their duties:**

### 3.4.4. Experience Matrix

#### 3.4.4.1. Area Qualifications

3.4.4.1.1. Civil - Graduate Civil Engineer or (BA/BS) graduate in construction management with 4 years experience in the type of work being performed on this project or engineering technician with 5 yrs related experience.

3.4.4.1.2. Mechanical - Graduate Mechanical Engineer or (BA/BS) graduate in construction management with 4 yrs related experience or engineering technician with an ICC certification as a Commercial Mechanical Inspector with 5 yrs related experience.

3.4.4.1.3. Electrical - Graduate Electrical Engineer or (BA/BS) graduate in construction management with 4 yrs related experience or engineering technician with an ICC certification as a Commercial Electrical Inspector with 5 yrs related experience.

3.4.4.1.4. Structural - Graduate Structural Engineer or (BA/BS) graduate in construction management with 4 yrs related experience or person with an ICC certification as a Reinforced Concrete Special Inspector and Structural Steel and Bolting Special Inspector (as applicable to the type of construction involved) with 5 yrs related experience.

3.4.4.1.5. Plumbing - Graduate Mechanical Engineer or (BA/BS) graduate in construction management with 4 yrs related experience, or person with an ICC certification as a Commercial Plumbing Inspector with 5 yrs related experience.

3.4.4.1.6. Concrete, Pavements and Soils Materials Technician (present while performing tests) with 2 yrs experience for the appropriate area

3.4.4.1.7. Testing, Adjusting and Balancing Specialist must be a member (TAB) Personnel of AABC or an experienced technician of the firm certified by the NEBB (present while testing, adjusting, balancing).

3.4.4.1.8. Design Quality Control Manager Registered Architect or Professional Engineer (not required on the construction site)

3.4.4.1.9. Registered Fire Protection Engineer with 4 years related experience or engineering technician with 5 yrs related experience (but see requirements for Fire Protection Engineer of Record to witness final testing in Section 01 10 00, paragraph 5.10, Fire Protection).

3.4.4.1.10. QC personnel assigned to the installation of the telecommunication system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification. In lieu of BICSI certification, QC personnel shall have a minimum of 5 years experience in the installation of the specified copper and fiber optic cable and components. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products. QC personnel shall witness and certify the testing of telecommunications cabling and equipment.

#### 3.4.5. Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager shall have completed the course entitled "Construction Quality Management for Contractors". This course is periodically offered at This course is periodically offered at Fort Worth District, Corps of Engineers Office, Federal Building, 819 Taylor Street, Fort Worth, Texas.. Inquire of the District or Division sponsoring the course for fees and other expenses involved, if any, for attendance at this course.

#### 3.4.6. Organizational Changes

When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

### 3.5. SUBMITTALS AND DELIVERABLES

Make submittals as specified in Section 01 33 00 **SUBMITTAL PROCEDURES**. The CQC organization shall certify that all submittals and deliverables are in compliance with the contract requirements.

### 3.6. CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. The CQC organization shall conduct at least three phases of control for each definable feature of the construction work as follows:

#### 3.6.1. Preparatory Phase

Perform this phase prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

3.6.1.1. A review of each paragraph of applicable specifications, reference codes, and standards. Make a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field at the preparatory inspection. Maintain these copies in the field, available for use by Government personnel until final acceptance of the work.

3.6.1.2. A review of the contract drawings.

3.6.1.3. A check to assure that all materials and/or equipment have been tested, submitted, and approved.

3.6.1.4. Review of provisions that have been made to provide required control inspection and testing.

3.6.1.5. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

3.6.1.6. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

3.6.1.7. A review of the appropriate activity hazard analysis to assure safety requirements are met.

3.6.1.8. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

3.6.1.9. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

3.6.1.10. Discussion of the initial control phase.

3.6.1.11. Notify the Government at least 24 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the preparatory phase actions by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

### 3.6.2. Initial Phase

Accomplish this phase at the beginning of a definable feature of work. Include the following actions:

3.6.2.1. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

3.6.2.2. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

3.6.2.3. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

3.6.2.4. Resolve all differences.

3.6.2.5. Check safety to include compliance with and upgrading of the Accident Prevention plan and activity hazard analysis. Review the activity analysis with each worker.

3.6.2.6. Notify the Government at least 24 hours in advance of beginning the initial phase. The CQC System Manager shall prepare and attach to the daily CQC report separate minutes of this phase. Indicate exact location of initial phase for future reference and comparison with follow-up phases.

3.6.2.7. Repeat the initial phase any time acceptable specified quality standards are not being met.

### 3.6.3. Follow-up Phase

Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Conduct final follow-up checks and correct deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work.

### 3.6.4. Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

## 3.7. TESTS

### 3.7.1. Testing Procedure

Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements and project design documents. Upon request, furnish to the Government

duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory, or establish an approved testing laboratory at the project site. The Contractor may elect to use a laboratory certified and accredited by the Concrete and cement Reference Laboratory (CCRL) or by AASHTO Materials Reference Laboratory (AMRL) for testing procedures that those organizations certify. The Contractor shall perform the following activities and record and provide the following data:

3.7.1.1. Verify that testing procedures comply with contract requirements and project design documents.

3.7.1.2. Verify that facilities and testing equipment are available and comply with testing standards.

3.7.1.3. Check test instrument calibration data against certified standards.

3.7.1.4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

3.7.1.5. Include results of all tests taken, both passing and failing tests, recorded on the CQC report for the date taken. Include specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

### 3.7.2. Testing Laboratories

#### 3.7.2.1. Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

#### 3.7.2.2. Capability Recheck

If the selected laboratory fails the capability check, the Government will assess the Contractor a charge of \$1,375 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

#### 3.7.3. Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

#### 3.7.4. Furnishing or Transportation of Samples for Government Quality Assurance Testing

The Contractor is responsible for costs incidental to the transportation of samples or materials. Deliver samples of materials for test verification and acceptance testing by the Government to the Corps of Engineers Laboratory, f.o.b., at the following address:

- For delivery by mail:  
Government contract laboratory designated by the Area Office.  
-  
-  
-
- For other deliveries:

Government contract laboratory designated by the Area Office. The Area or Resident Office will coordinate exact delivery location and dates for each.

-  
-  
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The area or resident office will coordinate, exact delivery location, and dates for each specific test.

### 3.8. COMPLETION INSPECTION

#### 3.8.1. Punch-Out Inspection

Near the end of the work, or any increment of the work established by a time stated in the SPECIAL CONTRACT REQUIREMENTS Clause, "Commencement, Prosecution, and Completion of Work", or by the specifications, the CQC Manager shall conduct an inspection of the work. Prepare a punch list of items which do not conform to the approved drawings and specifications and include in the CQC documentation, as required by paragraph DOCUMENTATION. The list of deficiencies shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

#### 3.8.2. Pre-Final Inspection

As soon as practicable after the notification above, the Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Correct any items noted on the Pre-Final inspection in a timely manner. Accomplish these inspections and any deficiency corrections required by this paragraph within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

#### 3.8.3. Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall attend the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups and major commands may also attend. The Government will formally schedule the final acceptance inspection based upon results of the Pre-Final inspection. Provide notice to the Government at least 14 days prior to the final acceptance inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

### 3.9. DOCUMENTATION

3.9.1. Maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers using government-provided software, QCS (see Section 01 45 01.10). The report includes, as a minimum, the following information:

3.9.1.1. Contractor/subcontractor and their area of responsibility.

3.9.1.2. Operating plant/equipment with hours worked, idle, or down for repair.

3.9.1.3. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

- 3.9.1.4. Test and/or control activities performed with results and references to specifications/drawings requirements. Identify the applicable control phase (Preparatory, Initial, Follow-up). List deficiencies noted, along with corrective action.
- 3.9.1.5. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- 3.9.1.6. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.
- 3.9.1.7. Offsite surveillance activities, including actions taken.
- 3.9.1.8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- 3.9.1.9. Instructions given/received and conflicts in plans and/or specifications.
- 3.9.1.10. Provide documentation of design quality control activities. For independent design reviews, provide, as a minimum, identity of the ITR team, the ITR review comments, responses and the record of resolution of the comments.
- 3.9.2. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. Furnish the original and one copy of these records in report form to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, submit one report for every 7 days of no work and on the last day of a no work period. Account for all calendar days throughout the life of the contract. The first report following a day of no work shall be for that day only. The CQC System Manager shall sign and date reports. The report shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel. The Contractor may submit these forms electronically, in lieu of hard copy.

### 3.10. NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

End of Section 01 45 04.00 10

**SECTION 01 50 02**  
**TEMPORARY CONSTRUCTION FACILITIES**

**1.0 OVERVIEW**

- 1.1. GENERAL REQUIREMENTS
- 1.2. AVAILABILITY AND USE OF UTILITY SERVICES
- 1.3. BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN
- 1.4. PROTECTION AND MAINTENANCE OF TRAFFIC
- 1.5. MAINTENANCE OF CONSTRUCTION SITE



## 1.0 OVERVIEW

### 1.1. GENERAL REQUIREMENTS

#### 1.1.1. Site Plan

Prepare a site plan indicating the proposed location and dimensions of any area to be fenced and used by the Contractor, the number of trailers to be used, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Also indicate if the use of a supplemental or other staging area is desired.

### 1.2. AVAILABILITY AND USE OF UTILITY SERVICES

1.2.1. See Section 00 72 00, Contract Clauses and Section 00 73 00, Special Contract Requirements, for Utility Availability requirements.

#### 1.2.2. Sanitation

Provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer. Government toilet facilities will not be available to Contractor's personnel.

#### 1.2.3. Telephone

Make arrangements and pay all costs for desired telephone facilities.

### 1.3. BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

#### 1.3.1. Bulletin Board

Immediately upon beginning of onsite work, provide a weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Display legible copies of the aforementioned data until work is completed. Remove the bulletin board from the site upon completion of the project.

#### 1.3.2. Project and Safety Signs

Erect a project sign and a site safety sign with informational details as provided by the Government at the Post award conference, within 15 days prior to any work activity on project site. Update the safety sign data daily, with light colored metallic or non-metallic numerals. Remove the signs from the site upon completion of the project. Engineer Pamphlet EP 310-1-6a contains the standardized layout and construction details for the signs. It can be found through a GOOGLE Search or try <http://www.usace.army.mil/publications/eng-pamphlets/ep310-1-6a/s-16.pdf>.

### 1.4. PROTECTION AND MAINTENANCE OF TRAFFIC

Provide access and temporary relocated roads as necessary to maintain traffic. Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Take measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, as required by the State and local authorities having jurisdiction. Protect the traveling public from damage to person and property.

The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. Investigate the adequacy of existing roads and the allowable load limit on these roads. Repair any damage to roads caused by construction operations.

#### 1.4.1. Haul Roads

The Contractor shall, at its own expense, construct access and haul roads necessary for proper prosecution of the work under this contract. Construct haul roads with suitable grades and widths. Avoid sharp curves, blind corners, and dangerous cross traffic. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads shall be subject to approval by the Contracting Officer. Provide adequate lighting to assure full and clear visibility for full width of haul road and work areas during any night work operations. Remove haul roads designated by the Contracting Officer upon completion of the work and restore those areas.

#### 1.4.2. Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Barricades shall be required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

#### 1.5. MAINTENANCE OF CONSTRUCTION SITE

Mow grass and vegetation located within the boundaries of the construction site for the duration of the project, from NTP to contract completion. Edge or neatly trim grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers from NTP to contract completion.

End of Section 01 50 02

**SECTION 01 57 20.00 10  
ENVIRONMENTAL PROTECTION**

**1.0 GENERAL REQUIREMENTS**

- 1.1. SUBCONTRACTORS
- 1.2. ENVIRONMENTAL PROTECTION PLAN
- 1.3. PROTECTION FEATURES
- 1.4. ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS
- 1.5. NOTIFICATION

**2.0 PRODUCTS (NOT USED)**

**3.0 EXECUTION**

- 3.1. LAND RESOURCES
- 3.2. WATER RESOURCES
- 3.3. AIR RESOURCES
- 3.4. CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL
- 3.5. RECYCLING AND WASTE MINIMIZATION
- 3.6. HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES
- 3.7. BIOLOGICAL RESOURCES
- 3.8. INTEGRATED PEST MANAGEMENT
- 3.9. PREVIOUSLY USED EQUIPMENT
- 3.10. MILITARY MUNITIONS
- 3.11. TRAINING OF CONTRACTOR PERSONNEL
- 3.12. POST CONSTRUCTION CLEANUP

## 1.0 GENERAL REQUIREMENTS

Minimize environmental pollution and damage that may occur as the result of construction operations. Protect the environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire duration of this contract. Comply with all applicable environmental Federal, State, and local laws and regulations. The Contractor shall be responsible for any delays resulting from failure to comply with environmental laws and regulations

### 1.1. SUBCONTRACTORS

Ensure compliance with this section by subcontractors.

### 1.2. ENVIRONMENTAL PROTECTION PLAN

1.2.1. The purpose of the Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues which the Contractor must address during construction. Define issues of concern within the Environmental Protection Plan as outlined in this section. Address each topic in the plan at a level of detail commensurate with the environmental issue and required construction task(s). Identify and discuss topics or issues which are not identified in this section, but which the Contractor considers necessary, after those items formally identified in this section. Prior to commencing construction activities or delivery of materials to the site, submit the Plan for review and Government approval. The Contractor shall meet with the Government prior to implementation of the Environmental Protection Plan, for the purpose of discussing the implementation of the initial plan; possible subsequent additions and revisions to the plan including any reporting requirements; and methods for administration of the Contractor's Environmental Plans. Maintain and keep the Environmental Protection Plan current onsite.

#### 1.2.2. Compliance

No requirement in this Section shall be construed as relieving the Contractor of any applicable Federal, State, and local environmental protection laws and regulations. During Construction, the Contractor shall be responsible for identifying, implementing, and submitting for approval any additional requirements to be included in the Environmental Protection Plan.

#### 1.2.3. Contents

The plan shall include, but shall not be limited to, the following:

1.2.3.1. Name(s) of person(s) within the Contractor's organization who is(are) responsible for ensuring adherence to the Environmental Protection Plan.

1.2.3.2. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site, if applicable

1.2.3.3. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel

1.2.3.4. Description of the Contractor's environmental protection personnel training program

1.2.3.5. An erosion and sediment control plan which identifies the type and location of the erosion and sediment controls to be provided. Include monitoring and reporting requirements to assure that the control measures are in compliance with the erosion and sediment control plan, Federal, State, and local laws and regulations. A Storm Water Pollution Prevention Plan (SWPPP) may be substituted for this plan.

1.2.3.6. Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on the site

1.2.3.7. Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Include measures to minimize the amount of mud transported onto paved public roads by vehicles or runoff.

1.2.3.8. Work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Include measures for marking the limits of use areas including methods for protection of features to be preserved within authorized work areas.

1.2.3.9. Drawing showing the location of on-installation borrow areas.

1.2.3.10. A spill control plan shall include the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by 40 CFR 68, 40 CFR 302, 40 CFR 355, and/or regulated under State or Local laws and regulations. The spill control plan supplements the requirements of EM 385-1-1. This plan shall include as a minimum:

- (a) The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual shall immediately notify the Government and the local Fire Department in addition to the legally required Federal, State, and local reporting channels (including the National Response Center 1-800-424-8802) if a reportable quantity is released to the environment. The plan shall contain a list of the required reporting channels and telephone numbers.
- (b) The name and qualifications of the individual who will be responsible for implementing and supervising the containment and cleanup
- (c) Training requirements for Contractor's personnel and methods of accomplishing the training
- (d) A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.
- (e) The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency
- (f) The methods and procedures to be used for expeditious contaminant cleanup

1.2.3.11. A solid waste management plan identifying waste minimization, collection, and disposals methods, waste streams (type and quantity), and locations for solid waste diversion/disposal including clearing debris and C&D waste that is diverted (salvaged, reused, or recycled). Detail the contractor's actions to comply with, and to participate in, Federal, state, regional, local government, and installation sponsored recycling programs to reduce the volume of solid waste at the source. Identify any subcontractors responsible for the transportation, salvage and disposal of solid waste. Submit licenses or permits for solid waste disposal sites that are not a commercial operating facility. Attach evidence of the facility's ability to accept the solid waste to this plan. A construction and demolition waste management plan, similar to the plan specified in the UFGS 01 74 19 (formerly 01572) may be used as the non-hazardous solid waste management plan. Provide a Non-Hazardous Solid Waste Diversion Report. Submit the report on the first working day after the first quarter that non-hazardous solid waste has been disposed and/or diverted and each quarter thereafter (e.g. the first working day of January, April, July, and October) until the end of the project. Additionally, a summary report, with all data fields, is required at the end of the project. The report shall indicate the total type and amount of waste generated, total type and amount of waste diverted, type and amount of waste sent to waste-to-energy facility and alternative daily cover, in tons along with the percent that was diverted. Maintain, track and report construction and demolition waste data in a manner such that the installation can enter the data into the Army SWAR database, which separates data by type of material. A cumulative report in LEED Letter Template format may be used but must be modified to include the date disposed of/diverted and include the above stated diversion data. NOTE: The Solid Waste Diversion Reports are separate documentation that the LEED documentation.

1.2.3.12. DELETED.

1.2.3.13. An air pollution control plan detailing provisions to assure that dust, debris, materials, trash, etc., do not become air borne and travel off the project site.

1.2.3.14. A contaminant prevention plan that: identifies potentially hazardous substances to be used on the job site; identifies the intended actions to prevent introduction of such materials into the air, water, or ground; and details provisions for compliance with Federal, State, and local laws and regulations for storage and handling of

these materials. In accordance with EM 385-1-1, include a copy of the Material Safety Data Sheets (MSDS) and the maximum quantity of each hazardous material to be on site at any given time in the contaminant prevention plan. Update the plan as new hazardous materials are brought on site or removed from the site. Reference this plan in the storm water pollution prevention plan, as applicable.

1.2.3.15. A waste water management plan that identifies the methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines. If a settling/retention pond is required, include the design of the pond including drawings, removal plan, and testing requirements for possible pollutants. If land application will be the method of disposal for the waste water, include a sketch showing the location for land application along with a description of the pretreatment methods to be implemented and any required permits. If surface discharge will be the method of disposal, include a copy of the permit and associated documents as an attachment prior to discharging the waste water. If disposal is to a sanitary sewer, include documentation that the waste water treatment plant Operator has approved the flow rate, volume, and type of discharge.

1.2.3.16. A historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on the project site: and/or identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in the area are discovered during construction. Include methods to assure the protection of known or discovered resources and shall identify lines of communication between Contractor personnel and the Government.

1.2.3.17. A pesticide treatment plan, updated, as information becomes available. Include: sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (i.e. pounds of active ingredient applied), equipment used for application and calibration of equipment. The Contractor is responsible for Federal, State, Regional and Local pest management record keeping and reporting requirements as well as any additional Installation specific requirements. Follow AR 200-5 Pest Management, Chapter 2, Section III "Pest Management Records and Reports" for data required to be reported to the Installation.

### 1.3. PROTECTION FEATURES

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS. Prior to start of any onsite construction activities, the Contractor and the Government shall make a joint condition survey. Immediately following the survey, the Contractor shall prepare a brief report including a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. Both the Contractor and the Government will sign this survey, upon mutual agreement as to its accuracy and completeness. The Contractor develop a plan that depicts how it will protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference which their preservation may cause to the Contractor's work under the contract.

### 1.4. ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations, requested by the Contractor, from the drawings, plans and specifications which may have an environmental impact will be subject to approval by the Government and may require an extended review, processing, and approval time. The Government reserves the right to disapprove alternate methods, even if they are more cost effective, if the Government determines that the proposed alternate method will have an adverse environmental impact.

### 1.5. NOTIFICATION

The Government will notify the Contractor in writing of any observed noncompliance with Federal, State or local environmental laws or regulations, permits, and other elements of the Contractor's Environmental Protection plan. The Contractor shall, after receipt of such notice, inform the Government of the proposed corrective action and take such action when approved by the Government. The Government may issue an order stopping all or part of the

work until satisfactory corrective action has been taken. No time extensions shall be granted or equitable adjustments allowed to the Contractor for any such suspensions. This is in addition to any other actions the Government may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

## **2.0 PRODUCTS (NOT USED)**

## **3.0 EXECUTION**

### **3.1. LAND RESOURCES**

Confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, identify any land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval. Do not attach or fasten any ropes, cables, or guys to any trees for anchorage unless specifically authorized. Provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Remove all stone, soil, or other materials displaced into uncleared areas..

#### **3.1.1. Work Area Limits**

Prior to commencing construction activities, mark the areas that need not be disturbed under this contract. Mark or fence isolated areas within the general work area which are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, any markers shall be visible in the dark. Personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

#### **3.1.2. Landscape**

Clearly identify trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved by marking, fencing, or wrapping with boards, or any other approved techniques. Restore landscape features damaged or destroyed during construction operations outside the limits of the approved work area.

#### **3.1.3. Erosion and Sediment Controls**

Provide erosion and sediment control measures in accordance with Federal, State, and local laws and regulations. Coordinate with approving authorities (federal, state, etc.) for specific requirements to be included in the plan. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's construction activities. Keep the area of bare soil exposed at any one time by construction operations to a minimum necessary. Construct or install temporary and permanent erosion and sediment control best management practices (BMPs). BMPs may include, but not be limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. Remove any temporary measures after the area has been stabilized.

#### **3.1.4. Contractor Facilities and Work Areas**

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Government. Make only approved temporary movement or relocation of Contractor facilities. Provide erosion and sediment controls for on-site borrow and spoil areas to prevent sediment from entering nearby waters. Control temporary excavation and embankments for plant and/or work areas to protect adjacent areas.

### **3.2. WATER RESOURCES**

Monitor construction activities to prevent pollution of surface and ground waters. Do not apply toxic or hazardous chemicals to soil or vegetation unless otherwise indicated. Monitor all water areas affected by construction activities. For construction activities immediately adjacent to impaired surface waters, the Contractor shall be capable of quantifying sediment or pollutant loading to that surface water when required by state or federally issued Clean Water Act permits.

### 3.2.1. Stream Crossings

Stream crossings shall allow movement of materials or equipment without violating water pollution control standards of the Federal, State, and local governments or impede state-designated flows.

### 3.2.2. Wetlands

Do not enter, disturb, destroy, or allow discharge of contaminants into any wetlands.

## 3.3. AIR RESOURCES

Comply with all Federal and State air emission and performance laws and standards for equipment operation, activities, or processes.

### 3.3.1. Particulates

Control dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants, including weekends, holidays and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the Federal, State, and local air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators or other methods are permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. Provide sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a particulate nuisance or hazard occurs. Comply with all State and local visibility regulations.

### 3.3.2. Odors

Control odors from construction activities at all times. Odors shall not cause a health hazard and shall be in compliance with State regulations and/or local ordinances.

### 3.3.3. Sound Intrusions

Keep construction activities under surveillance and control to minimize environment damage by noise. Comply with the provisions of the state and Installation rules.

### 3.3.4. Burning

Burning is not allowed on the project site unless specified in other sections of the specifications or by written authorization. Specific times, locations, and manners of burning shall be subject to approval.

## 3.4. CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

Disposal of wastes shall be as directed below, unless otherwise specified in other sections and/or shown on the drawings.

### 3.4.1. Solid Wastes

Place solid wastes (excluding clearing debris) in containers which are emptied on a regular schedule. Conduct handling, storage, and disposal to prevent contamination. Employ segregation measures so that no hazardous or toxic waste will become co-mingled with solid waste. Transport solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. The minimum acceptable off-site solid waste disposal option is a Subtitle D RCRA permitted landfill. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. Comply with Federal, State, and local laws and regulations pertaining to the use of landfill areas.

### 3.4.2. Chemicals and Chemical Wastes



Dispense chemicals, ensuring no spillage to the ground or water. Perform and document periodic inspections of dispensing areas to identify leakage and initiate corrective action. The Government may periodically review this documentation. Collect chemical waste in corrosion resistant, compatible containers. Monitor and remove collection drums to a staging or storage area when contents are within 6 inches of the top. Classify, manage, store, and dispose of wastes in accordance with Federal, State, and local laws and regulations.

#### 3.4.3. Contractor Generated Hazardous Wastes/Excess Hazardous Materials

Hazardous wastes are defined in 40 CFR 261, or are as defined by applicable state and local regulations. Hazardous materials are defined in 49 CFR 171 - 178. At a minimum, manage and store hazardous waste in compliance with 40 CFR 262. Take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing. Segregate hazardous waste from other materials and wastes; protect it from the weather by placing it in a safe covered location and take precautionary measures, such as berming or other appropriate measures, against accidental spillage. Store, describe, package, label, mark, and placard hazardous waste and hazardous material in accordance with 49 CFR 171 - 178, state, and local laws and regulations. Transport Contractor generated hazardous waste off Government property in accordance with the Environmental Protection Agency and the Department of Transportation laws and regulations. Dispose of hazardous waste in compliance with Federal, State and local laws and regulations. Immediately report spills of hazardous or toxic materials to the Government and the Facility Environmental Office. Contractor will be responsible for cleanup and cleanup costs due to spills. Contractor is responsible for the disposition of Contractor generated hazardous waste and excess hazardous materials.

#### 3.4.4. Fuel and Lubricants

Conduct storage, fueling and lubrication of equipment and motor vehicles in a manner that affords the maximum protection against spill and evaporation. Manage and store fuel, lubricants and oil in accordance with all Federal, State, Regional, and local laws and regulations.

### 3.5. RECYCLING AND WASTE MINIMIZATION

Participate in State and local government sponsored recycling programs. The Contractor is further encouraged to minimize solid waste generation throughout the duration of the project. Line and berm fueling areas and establish storm water control structures at discharge points for site run-off. Keep a liquid containment clean-up kit available at the fueling area.

### 3.6. HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Existing historical, archaeological, and cultural resources within the Contractor's work area are shown on the drawings. Protect and preserve these resources during the life of the Contract. Temporarily suspend all activities that may damage or alter such resources, if any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found during excavation or other construction activities. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, notify the Government so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. Cease all activities that may result in impact to or the destruction of these resources. Secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources.

### 3.7. BIOLOGICAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants, including their habitat. Protect threatened and endangered animal and plant species including their habitat in accordance with Federal, State, Regional, and local laws and regulations.

### 3.8. INTEGRATED PEST MANAGEMENT

Coordinate, through the Government, with the Installation Pest Management Coordinator (IPMC) at the earliest possible time prior to pesticide application, in order to minimize impacts to existing fauna and flora. Discuss

integrated pest management strategies with the IPMC and receive concurrence from the IPMC, through the COR, prior to the application of any pesticide associated with these specifications. Give IMPC personnel the opportunity to be present at all meetings concerning treatment measures for pest or disease control and during application of the pesticide. The use and management of pesticides are regulated under 40 CFR 152 - 186.

#### 3.8.1. Pesticide Delivery and Storage

Deliver pesticides, approved for use on the Installation, to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

#### 3.8.2. Qualifications

Use the services of a subcontractor for pesticide application whose principal business is pest control. The subcontractor shall be licensed and certified in the state where the work is to be performed.

#### 3.8.3. Pesticide Handling Requirements

Formulate, treat with, and dispose of pesticides and associated containers in accordance with label directions.

#### 3.8.4. Application

A state certified pesticide applicator shall apply pesticides in accordance with EPA label restrictions and recommendations.

### 3.9. PREVIOUSLY USED EQUIPMENT

Clean all previously used construction equipment prior to bringing it onto the project site. Ensure that the equipment is free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. Consult with the USDA jurisdictional office for additional cleaning requirements.

### 3.10. MILITARY MUNITIONS

Immediately stop work in that area and immediately inform the Government, in the event military munitions, as defined in 40 CFR 260, are discovered or uncovered.

### 3.11. TRAINING OF CONTRACTOR PERSONNEL

Train personnel in all phases of environmental protection and pollution control. Conduct environmental protection/pollution control meetings for all Contractor personnel prior to commencing construction activities. Conduct additional meetings for new personnel and when site conditions change. The training and meeting agenda shall include methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, wetlands, and endangered species and their habitat that are known to be in the area.

### 3.12. POST CONSTRUCTION CLEANUP

Clean up all areas used for construction in accordance with Contract Clause: "Cleaning Up". Unless otherwise instructed in writing, obliterate all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. Grade, fill and seed the entire disturbed area, unless otherwise indicated.

**SECTION 01 62 35  
RECYCLED/RECOVERED MATERIAL**

**1.0 GENERAL**

1.1. REFERENCES

1.2. OBJECTIVES

1.3. EPA DESIGNATED ITEMS INCORPORATED IN THE WORK

1.4. EPA PROPOSED ITEMS INCORPORATED IN THE WORK

1.5. EPA LISTED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN THE WORK

## 1.0 GENERAL

### 1.1. REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

- U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
- 40 CFR 247 Comprehensive Procurement Guideline for Products Containing Recovered Materials

### 1.2. OBJECTIVES

Government procurement policy is to acquire, in a cost effective manner, items containing the highest percentage of recycled and recovered materials practicable consistent with maintaining a satisfactory level of competition without adversely affecting performance requirements or exposing suppliers' employees to undue hazards from the recovered materials. The Environmental Protection Agency (EPA) has designated certain items which must contain a specified percent range of recovered or recycled materials. The Contractor shall make all reasonable efforts to use recycled and recovered materials in providing the EPA designated products and in otherwise utilizing recycled and recovered materials in the execution of the work.

### 1.3. EPA DESIGNATED ITEMS INCORPORATED IN THE WORK

Materials that have been designated by EPA as being products which are or can be made with recovered or recycled materials, when incorporated into the work under this contract, shall contain at least the minimum percentage of recycled or recovered materials indicated by EPA unless adequate justification (non-availability) for non-use is provided. When a designated item is specified as an option to a non-designated item, the designated item requirements apply only if the designated item is used in the work.

### 1.4. EPA PROPOSED ITEMS INCORPORATED IN THE WORK

Products other than those designated by EPA are still being researched and are being considered for future Comprehensive Procurement Guideline (CPG) designation. It is recommended that these items, when incorporated in the work under this contract, contain the highest practicable percentage of recycled or recovered materials, provided specified requirements are also met.

### 1.5. EPA LISTED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN THE WORK

There are many products listed in 40 CFR 247 which have been designated or proposed by EPA to include recycled or recovered materials that may be use by the Contractor in performing the work but will not be incorporated into the work. These products include office products, temporary traffic control products, and pallets. It is recommended that these non-construction products, when used in the conduct of the work, contain the highest practicable percentage of recycled or recovered materials and that these products be recycled when no longer needed.

End of Section 01 62 35

**SECTION 01 78 02.00 10  
CLOSEOUT SUBMITTALS**

**1.0 OVERVIEW**

- 1.1. SUBMITTALS
- 1.2. PROJECT RECORD DOCUMENTS
- 1.3. EQUIPMENT DATA
- 1.4. CONSTRUCTION WARRANTY MANAGEMENT
- 1.5. MECHANICAL TESTING, ADJUSTING, BALANCING, AND COMMISSIONING
- 1.6. OPERATION AND MAINTENANCE MANUALS
- 1.7. FIELD TRAINING
- 1.8. PRICING OF CONTRACTOR-FURNISHED AND INSTALLED PROPERTY AND GOVERNMENT-FURNISHED CONTRACTOR-INSTALLED PROPERTY
- 1.9. LEED REVIEW MEETINGS
- 1.10. RED ZONE MEETING
- 1.11. FINAL CLEANING
- 1.12. INTERIM FORM DD1354 "TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY"

**EXHIBIT 1 SAMPLE RED ZONE MEETING CHECKLIST**

## 1.0 OVERVIEW

### 1.1. SUBMITTALS

Government approval is required for any submittals with a "G" designation; submittals not having a "G" designation are for Designer of Record approval or for information only. Submit the following in accordance with Section 01 33 00 submittals:

#### SD-02 Shop Drawings

- As-Built Drawings - G
  - Drawings showing final as-built conditions of the project. Provide electronic drawing files as specified in Section 01 33 16, 3 sets of blue-line prints and one set of the approved working as-built drawings.

#### SD-03 Product Data

- As-Built Record of Equipment and Materials
  - Two copies of the record listing the as-built materials and equipment incorporated into the construction of the project.
- Construction Warranty Management Plan
  - Three sets of the construction warranty management plan containing information relevant to the warranty of materials and equipment incorporated into the construction project, including the starting date of warranty of construction. Furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.
- Warranty Tags
  - Two record copies of the warranty tags showing the layout and design.
- Final Cleaning
  - Two copies of the listing of completed final clean-up items.

### 1.2. PROJECT RECORD DOCUMENTS

#### 1.2.1. As-Built Drawings – G

An as-built drawing is a construction drawing revised to reflect the final as-built conditions of the project as a result of modifications and corrections to the project design required during construction. The final as-built drawings shall not have the appearance of marked up drawings, but that of professionally prepared drawings as if they were the "as designed" drawings.

#### 1.2.2. Maintenance of As-Built Drawings

1.2.2.1. The Configuration Management Plan shall describe how the Contractor will maintain up-to-date drawings, how it will control and designate revisions to the drawings and specifications (In accordance with Special Contract Requirement: ***Deviating from the Accepted Design*** and Section 01 33 16: ***Design after Award***, the Designer of Record's approval is necessary for any revisions to the accepted design).

1.2.2.2. Make timely updates, carefully maintaining a record set of working as-built drawings at the job site, marked in red, of all changes and corrections from the construction drawings. Enter changes and corrections on drawings promptly to reflect "Current Construction". Perform this update no less frequently than weekly for the blue line drawings and update no less frequently than quarterly for the CADD/CAD and BIM files, which were prepared previously in accordance with Section 01 33 16. Include a confirmation that the as-builts are up to date with the submission of the monthly project schedule.

1.2.2.3. If the DB Contractor fails to maintain the as-built drawings as required herein, the Government will retain from the monthly progress payment, an amount representing the estimated monthly cost of maintaining the as-built drawings. Final payment with respect to separately priced facilities or the contract as a whole will be withheld until the Contractor submits acceptable as-built drawings and the Government approves them.

1.2.2.4. The marked-up set of drawings shall reflect any changes, alterations, adjustments or modifications. Changes must be reflected on all sheets affected by the change. Changes shall include marking the drawings to reflect structural details, foundation layouts, equipment sizes, and other extensions of design.

1.2.2.5. Typically, room numbers shown on the drawings are selected for design convenience and do not represent the actual numbers intended for use by the end user. Final as-built drawings shall reflect actual room numbers adopted by the end user.

1.2.2.6. If there is no separate contract line item (CLIN) for as-built drawings, the Government will withhold the amount of \$35,000, or 1% of the present construction value, whichever is the greater, until the final as-built drawing submittal has been approved by the Government.

### 1.2.3. Underground Utilities

The drawings shall indicate, in addition to all changes and corrections, the actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Locate Valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Record average elevation of the top of each run or underground structure..

### 1.2.4. Partial Occupancy

For projects where portions of construction are to be occupied or activated before overall project completion, including portions of utility systems, supply as-built drawings for those portions of the facility being occupied or activated at the time the facility is occupied or activated. Show this same as-built information previously furnished on the final set of as-built drawings.

### 1.2.5. As-Built Conditions That are Different From the construction Drawings

Accurately reflect all as-built conditions that are different, such as dimensions, road alignments and grades, and drainage and elevations, from the construction drawings on each drawing. If the as-built condition is accurately reflected on a shop drawing, then furnish that shop drawing in CADD format. Reference the final as-built construction drawing the shop drawing file that includes the as-built information. In turn, the shop drawing shall reference the applicable construction as-built drawing. Delete any options shown on drawings and not selected clearly reflect options selected on final as-built drawings.

### 1.2.6. Additional As-Built Information that Exceeds the Detail Shown on the construction Drawings:

These as-built conditions include those that reflect structural details, foundation layouts, equipment, sizes, mechanical and electrical room layouts and other extensions of design, that were not shown in the project design documents because the exact details were not known until after the time of approved shop drawings. It is recognized that these shop drawing submittals (revised showing as-built conditions) will serve as the as-built record without actual incorporation into the construction drawings, piping, and equipment drawings. Include locations of all explorations, logs of all explorations, and results of all laboratory testing, including those provided by the Government. Furnish all such shop drawings in CADD /CADformat. Include fire protection details, such as wiring, performed for the design of the project.

### 1.2.7. Final As-Built Drawings

Submit final as-built CADD/CAD and BIM Model(s) and Facility Data files at the time of Beneficial Occupancy of the project or at a designated phase of the project. In the event the Contractor accomplishes additional work after this submittal, which changes the as-built conditions, submit a new DVD with all drawing sheets and three blue-line copies of affected sheets which depict additional changes.

### 1.2.8. Title Blocks

In accordance with the configuration management plan, clearly mark title blocks to indicate final as-built drawings.

### 1.2.9. Other As-Built Documents

Provide scans of all other documents such as design analysis, catalog cuts, certification documents that are not available in native electronic format in an organized manner in Adobe.pdf format.

#### 1.2.9.1. LEED Documentation

Update LEED documentation on at least a monthly basis and have it available for review by the Government on the jobsite at all times during construction. Submit the final LEED Project Checklist(s), final LEED submittals checklist and complete project documentation, verifying the final LEED score and establishing the final rating. Provide full support to the validation review process, including credit audits. See also the LEED documentation requirements in Section 01 33 16, DESIGN AFTER AWARD.

#### 1.2.9.2. GIS Documentation

Provide final geo-referenced GIS database of the new building footprint along with any changes made to exterior of the building. The intent of capturing the final building footprint and exterior modifications in a GIS database is to provide the installation with a data set of the comprehensive changes made to the landscape as a result of the construction project. The Government will incorporate this data set into the installations existing GIS MasterPlan or Enterprise GIS system. The GIS database deliverable shall follow a standard template provided to the Contractor by the Government, adhere to detailed specifications outlined in ECB No 2006-15, and be documented using the Federal Geographic Data Committee (FGDC) metadata standard.

## 1.3. EQUIPMENT DATA

### 1.3.1. Real Property Equipment

Provide an Equipment-in-Place list of all installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. Include the cost of each piece of installed property F.O.B. construction site. For each of the items which is specified herein to be guaranteed for a specified period from the date of acceptance thereof, provide the following information: The name, serial and model number address of equipment supplier, or manufacturer originating the guaranteed item. The Contractor's guarantee to the Government of these items will not be limited by the terms of any manufacturer's guarantee to the Contractor. Furnish the list as one (1) reproducible and three (3) copies thirty (30) calendar days before completion of any segment of the contract work which has an incremental completion date.

### 1.3.2. Maintenance and Parts Data

Furnish a brochure, catalog cut, parts list, manufacturer's data sheet or other publication showing detailed parts data on all other equipment subject to repair and maintenance procedures not otherwise required in Operations and Maintenance Manuals specified elsewhere in this contract. Distribution of directives shall follow the same requirements as listed in paragraph above.

### 1.3.3. Construction Specifications

Furnish permanent electronic files of final as-built construction specifications, including modifications thereto, with the as-built drawings.

## 1.4. CONSTRUCTION WARRANTY MANAGEMENT

1.4.1. Prior to the end of the one year warranty, the Government may conduct an infrared roof survey on any project involving a membrane roofing system. This survey will be conducted in accordance with ASTM C1153-90, "Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging". The Contractor shall replace all damaged materials and locate and repair sources of moisture penetration.



## 1.4.2. Management

### 1.4.2.1. Warranty Management Plan

Develop a warranty management plan containing information relevant to the clause **Warranty of Construction** in FAR 52.246-21. Submit the warranty management plan for Government approval at least 30 days before the planned pre-warranty conference. In the event of phased turn-over of the contract, update the Warranty Management Plan as necessary to include latest information required. Include all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan shall be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below shall include due date and whether item has been submitted or was accomplished. Submit warranty information made available during the construction phase prior to each monthly pay estimate. Assemble information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period shall begin on the date of project acceptance and shall continue for the full product warranty period. The Contractor, Government, including the Customer Representative shall jointly conduct warranty inspections, 4 months and 9 months, after acceptance. The warranty management plan shall include, but shall not be limited to, the following information:

- (1) Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the contractors, subcontractors, manufacturers or suppliers involved.
- (2) Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.
- (3) A list for each warranted equipment, item, feature of construction or system indicating:
  - (i) Name of item.
  - (ii) Model and serial numbers.
  - (iii) Location where installed.
  - (iv) Name and phone numbers of manufacturers or suppliers.
  - (v) Names, addresses and telephone numbers of sources of spare parts.
  - (vi) Warranties and terms of warranty. Include one-year overall warranty of construction. Indicate those items, which have extended warranties with separate warranty expiration dates.
  - (vii) Cross-reference to warranty certificates as applicable.
  - (viii) Starting point and duration of warranty period.
  - (ix) Summary of maintenance procedures required to continue the warranty in force.
  - (x) Cross-reference to specific pertinent Operation and Maintenance manuals.
  - (xi) Organization, names and phone numbers of persons to call for warranty service.
  - (xii) Typical response time and repair time expected for various warranted equipment.
- (4) The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.
- (5) Procedure and status of tagging of all equipment covered by extended warranties.
- (6) Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

## 1.4.3. Performance Bond

1.4.3.1. The Contractor's Performance Bond will remain effective throughout the construction warranty period.

1.4.3.2. In the event the Contractor or his designated representative(s) fails to commence and diligently pursue any work required under this clause, and in a manner pursuant to the requirements thereof, the Government shall have

a right to demand that said work be performed under the Performance Bond by making written notice on the surety. If the surety fails or refuses to perform the obligation it assumed under the Performance Bond, the Government shall have the work performed by others, and after completion of the work, may make demand for reimbursement of any or all expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

1.4.3.3. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Government will have the right to recoup expenses from the bonding company.

1.4.3.4. Following oral or written notification of required warranty repair work, the Contractor will respond as dictated by para. 1.4.5. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Government to proceed against the Contractor as outlined in the paragraph 1.4.5.5 and/or above.

#### 1.4.4. Pre-Warranty Conference

Prior to contract completion, or completion of any phase or portion of contract to be turned over, and at a time designated by the Contracting Officer, the Contractor shall meet with the Government to develop a mutual understanding with respect to the requirements of this clause. Communication procedures for Contractor notification of warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Government for the execution of the construction warranty shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor will furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, will be continuously available, and will be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of his responsibilities in connection with other portions of this provision.

#### 1.4.5. Contractor's Response to Warranty Service Requirements.

Following Government oral or written notification, which may include authorized installation maintenance personnel, the Contractor shall respond to warranty service requirements in accordance with the "Warranty Service Priority List" and the three categories of priorities listed below. Submit a report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and backcharge the construction warranty payment item established.

1.4.5.1. First Priority Code 1 Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

1.4.5.2. Second Priority Code 2 Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

1.4.5.3. Third Priority Code 3 All other work to be initiated within 3 work days and work continuously to completion or relief.

1.4.5.4. The "Warranty Service Priority List" is as follows:

- Code 1 - Air Conditioning System
  - (a) Buildings with computer equipment.
  - (b) Barracks, mess halls (entire building down).
- Code 2 - Air Conditioning Systems
  - (a) Recreational support.
  - (b) Air conditioning leak in part of building, if causing damage.
  - (c) Air conditioning system not cooling properly

- (d) Admin buildings with Automated Data Processing (ADP) equipment not on priority list.
  - Code 1 - Doors
- (a) Overhead doors not operational.
  - Code 1 - Electrical
- (a) Power failure (entire area or any building operational after 1600 hours).
- (b) Traffic control devices.
- (c) Security lights.
- (d) Smoke detectors and fire alarm systems
- (e) Power or lighting failure to an area, facility, portion of a facility, which may adversely impact health, safety, security, or the installation's mission requirement, or which may result in damage to property.
  - Code 2 - Electrical
- (a) Power failure (no power) for unoccupied buildings or portions thereof or branch circuits within occupied buildings, not listed as Code 1.
- (a) Receptacle and lights, not listed as code 1.
  - Code 3 - Electrical
- (a) Street, parking area lights
  - Code 1 - Gas
- (a) Leaks and breaks.
- (b) No gas to cantonment area.
  - Code 1 - Heat
- (a) Area power failure affecting heat.
- (b) Heater in unit not working.
  - Code 2 Heat
- (a) All heating system failures not listed as Code 1.
  - Code 3 - Interior
- (a) Floor damage
- (b) Paint chipping or peeling
  - Code 1 - Intrusion Detection Systems - N/A.
  - Code 2 - Intrusion Detection Systems other than those listed under Code 1
  - Code 1 - Kitchen Equipment
- (a) Dishwasher.
- (b) All other equipment hampering preparation of a meal.
  - Code 2 - Kitchen Equipment
- (a) All other equipment not listed under Code 1.
  - Code 2 - Plumbing
- (a) Flush valves not operating properly
- (b) Fixture drain, supply line commode, or water pipe leaking.
- (c) Commode leaking at base.
  - Code 3 - Plumbing
- (a) Leaking faucets

- Code 1 - Refrigeration
  - (a) Mess Hall.
  - (b) Medical storage.
- Code 2 - Refrigeration
  - (a) Mess hall - other than walk-in refrigerators and freezers.
- Code 1 - Roof Leaks
  - (a) Temporary repairs will be made where major damage to property is occurring.
- Code 2 - Roof Leaks
  - (a) Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.
- Code 1 - Sprinkler System
  - (a) All sprinkler systems, valves, manholes, deluge systems, and air systems to sprinklers.
- Code 1 - Tank Wash Racks (Bird Baths)
  - (a) All systems which prevent tank wash.
- Code 1 - Water (Exterior)
  - (a) Normal operation of water pump station.
- Code 2 - Water (Exterior)
  - (a) No water to facility.
- Code 1 - Water, Hot (and Steam)
  - (a) Barracks (entire building).
- Code 2 - Water, Hot
  - (a) No hot water in portion of building listed under Code 1

1.4.5.5. Should parts be required to complete the work and the parts are not immediately available, the Contractor shall have a maximum of 12 hours after arrival at the job site to provide the Government, with firm written proposals for emergency alternatives and temporary repairs for Government participation with the Contractor to provide emergency relief until the required parts are available on site for the Contractor to perform permanent warranty repair. The Contractor's proposals shall include a firm date and time that the required parts shall be available on site to complete the permanent warranty repair. The Government will evaluate the proposed alternatives and negotiate the alternative considered to be in the best interest of the Government to reduce the impact of the emergency condition. Alternatives considered by the Government will include the alternative for the Contractor to "Do Nothing" while waiting until the required parts are available to perform permanent warranty repair. Negotiating a proposal which will require Government participation and the expenditure of Government funds shall constitute a separate procurement action by the using service.

#### 1.4.6. Equipment Warranty Identification Tags

1.4.6.1. Provide warranty identification tags at the time of installation and prior to substantial completion shall provide warranty identification tags on all Contractor and Government furnished equipment which the Contractor has installed.

- (a) The tags shall be suitable for interior and exterior locations, resistant to solvents, abrasion, and to fading caused by sunlight, precipitation, etc. These tags shall have a permanent pressure-sensitive adhesive back, and they shall be installed in a position that is easily (or most easily) noticeable. Tag each component of contractor furnished equipment that has differing warranties on its components.
- (b) Submit sample tags, representing how the other tags will look, for Government review and approval.
- (c) Tags for Warranted Equipment: The tag for this equipment shall be similar to the following: Exact format and size will be as approved.

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EQUIPMENT WARRANTY - CONTRACTOR FURNISHED EQUIPMENT

MFG NAME

MODEL NO.

SERIAL NO.

CONTRACT NO.

CONTRACTOR NAME

CONTRACTOR WARRANTY EXPIRES

MFG WARRANTY(IES) EXPIRE

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EQUIPMENT WARRANTY - GOVERNMENT FURNISHED EQUIPMENT

MFG NAME

MODEL NO.

SERIAL NO.

CONTRACT NO.

DATE EQUIP PLACED IN SERVICE

MFG WARRANTY(IES) EXPIRE

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(d) If the manufacturer's name (MFG), model number and serial number are on the manufacturer's equipment data plate and this data plate is easily found and fully legible, this information need not be duplicated on the equipment warranty tag

1.4.6.2. Execution: Complete the required information on each tag and install these tags on the equipment by the time of and as a condition of final acceptance of the equipment.

## 1.5. MECHANICAL TESTING, ADJUSTING, BALANCING, AND COMMISSIONING

Submit; all reports, statements, certificates, and completed checklists for testing, adjusting, balancing, and commissioning of mechanical systems prior to final inspection and transfer of the completed facility for approval, as specified in applicable technical specification sections.

## 1.6. OPERATION AND MAINTENANCE MANUALS

### 1.6.1. General Requirements

1.6.1.1. Inasmuch as the operations and maintenance manuals are required to operate and maintain the facility, the operations and maintenance (O&M) manuals will be considered a requirement prior to substantial completion of any facility to be turned over to the Government. Beneficial occupancy of all or portions of a facility prior to substantial completion will not relieve the Contractor of liquidated damages, if substantial completion exceeds the required completion date.

1.6.1.2. Provide one permanent electronic copy on CD-ROM and 2 hard copies of the Equipment Operating, Maintenance, and Repair Manuals. Provide separate manuals for each utility system as defined hereinafter. Submit Operations and Maintenance manuals for approval before field training or 90 days before substantial completion (whichever occurs earlier). If there is no separate CLIN for O&M Manuals, the Government will withhold an amount representing \$20,000, as non-progressed work, until submittal and approval of all O&M manuals are complete.

### 1.6.2. Definitions

#### 1.6.2.1. Equipment

A single piece of equipment operating alone or in conjunction with other equipment to accomplish a system function.

#### 1.6.2.2. System

A combination of one or more pieces of equipment which function together to accomplish an intended purpose (i.e. HVAC system is composed of many individual pieces of equipment such as fans, motors, compressors, valves, sensors, relays, etc.)

### 1.6.3. Hard Cover Binders

The manuals shall be hard cover with posts, or 3-ring binders, so sheets may be easily substituted. Print the following identification on the cover: the words "EQUIPMENT OPERATING, MAINTENANCE, AND REPAIR MANUALS," the project name, building number, and an indication of utility or systems covered, the name of the Contractor, and the Contract number. Manuals shall be approximately 8-1/2 by 11-inches with large sheets folded in and capable of being easily pulled out for reference. All manuals for the project must be similar in appearance, and be of professional quality.

### 1.6.4. Warning Page

Provide a warning page to warn of potential dangers (if they exist, such as high voltage, toxic chemicals, flammable liquids, explosive materials, carcinogens, high pressures, etc.). Place the warning page inside the front cover and in front of the title page. Include any necessary Material Safety Data Sheets (MSDS) here.

### 1.6.5. Title Page

The title page shall include the same information shown on the cover and show the name of the preparing firm and the date of publication.

#### 1.6.6. Table of Contents

Each volume of the set of manuals for this project shall include a table of contents, for the entire set, broken down by volume.

#### 1.6.7. GENERAL

Organize manuals according to the following format, and include information for each item of equipment. Submit a draft outline and table of contents for approval at 50% contract completion.

#### TABLE OF CONTENTS

##### PART I: Introduction

- Equipment Description
- Functional Description
- Installation Description

##### PART II: Operating Principles

##### PART III: Safety

##### PART IV: Preventive Maintenance

- Preventive Maintenance Checklist, Lubrication
- Charts and Diagrams

##### PART V: Spare Parts Lists

- Troubleshooting Guide
- Adjustments
- Common Repairs and Parts Replacement

##### PART VI: Illustrations

#### 1.6.7.1. Part I-Introduction

Part I shall provide an introduction, equipment or system description, functional description and theory of operation, and installation instructions for each piece of equipment. Include complete instructions for uncrating, assembly, connection to the power source and pre-operating lubrication in the installation instructions as applicable. Illustrations, including wiring and cabling diagrams, are required as appropriate in this section. Include halftone pictures of the equipment in the introduction and equipment description, as well as system layout drawings with each item of equipment located and marked. Do not use copies of previously submitted shop drawings in these manuals.

#### 1.6.7.2. Part II-Operating Principles

Part II shall provide complete instructions for operating the system, and each piece of equipment. Illustrations, halftone pictures, tables, charts, procedures, and diagrams are required when applicable. This will include step-by-step procedures for start-up and shutdown of both the system and each component piece of equipments, as well as adjustments required to obtain optimum equipment performance, and corrective actions for malfunctions. Show performance sheets and graphs showing capacity data, efficiencies, electrical characteristics, pressure drops, and flow rates here, also. Marked-up catalogs or catalog pages do not satisfy this requirement. Present performance information as concisely as possible with only data pertaining to equipment actually installed. Include actual test data collected for Contractor performance here.

#### 1.6.7.3. Part III-Safety

Part III shall contain the general and specific safety requirements peculiar to each item of equipment. Repeat safety information as notes cautions and warnings in other sections where appropriate to operations described.

#### 1.6.7.4. Part IV-Preventive Maintenance

Part IV shall contain a troubleshooting guide, including detailed instructions for all common adjustments and alignment procedures, including a detailed maintenance schedule. Also include a diagnostic chart showing symptoms and solutions to problems. Include test hookups to determine the cause, special tools and test equipment, and methods for returning the equipment to operating conditions. Information may be in chart form or in tabular format with appropriate headings. Include instructions for the removal, disassembly, repair, reassembly, and replacement of parts and assemblies where applicable and the task is not obvious.

#### 1.6.7.5. Part V-Spare Parts List

Part V shall contain a tabulation of description data and parts location illustrations for all mechanical and electrical parts. The heading of the parts list shall clearly identify the supplier, purchase order number, and equipment. Include the unit price for each part. List parts by major assemblies, and arrange the listing in columnar form. Include names and addresses of the nearest manufacturer's representatives, as well as any special warranty information. Provide a list of spare parts that are recommended to be kept in stock by the Government installation.

#### 1.6.7.6. Part VI-Illustrations

Part VI shall contain assembly drawings for the complete equipment or system and for all major components. Include complete wiring diagrams and schematics. Other illustrations, such as exploded views, block diagrams, and cutaway drawings, are required as appropriate.

#### 1.6.8. Framed Instructions

Post framed instructions are required for substantial completion. Post framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, including equipment, ductwork, piping valves, dampers, and control sequence at a location near the equipment described. Prepare condensed operating instructions explaining preventive maintenance procedures methods of checking the system for normal safe operation, valve schedule and procedures for safely starting and stopping the system in type form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. Submit proposed diagrams, instructions, and other sheets prior to posting. Post the framed instructions before field training.

#### 1.6.9. (Reserved. See 1.7 for Field Training)

#### 1.6.10. System/Equipment Requirements

##### 1.6.10.1. Facility Heating System

Provide information on the following equipment: boilers, water treatment, chemical feed pumps and tanks, converters, heat exchangers, pumps, unit heaters, fin-tube radiation, air handling units (both heating only and heating and cooling), and valves (associated with heating systems).

##### 1.6.10.2. Air-Conditioning Systems

Provide information in chillers, packaged air-conditioning equipment, towers, water treatment, chemical feed pumps and tanks, air-cooled condensers, pumps, compressors, air handling units, and valves (associated with air-conditioning systems).

##### 1.6.10.3. Temperature Control and HVAC Distribution Systems

Provide all information described for the following equipment: valves, fans, air handling units, pumps, boilers, converters and heat exchangers, chillers, water cooled condensers, cooling towers, and fin-tube radiation, control air compressors, control components (sensors, controllers, adapters and actuators), and flow measuring equipment.



#### 1.6.10.4. Central Heating Plants

Provide the information described for the following equipment: boilers, converters, heat exchangers, pumps, fans, steam traps, pollution control equipment, chemical feed equipment, control systems, fuel handling equipment, de-aerators, tanks (flash, expansion, return waters, etc.), water softeners, and valves.

#### 1.6.10.5. Heating Distribution Systems

Provide the information described for the following equipment: valves, fans, pumps, converters and heat exchangers, steam traps, tanks (expansion, flash, etc.), and piping systems.

#### 1.6.10.6. Exterior Electrical Systems

Provide information on the following equipment: power transformers, relays, reclosers, breakers, and capacitor bank controls.

#### 1.6.10.7. Interior Electrical Systems

Provide information on the following equipment: relays, motor control centers, switchgear, solid state circuit breakers, motor controller, EPS lighting systems, wiring diagrams and troubleshooting flow chart on control systems, and special grounding systems.

#### 1.6.10.8. Energy Monitoring and Control Systems

The maintenance manual shall include descriptions of maintenance for all equipment, including inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective components.

#### 1.6.10.9. Domestic Water Systems

Provide the identified information on the following equipment: tanks, unit process equipment, pumps, motors, control and monitoring instrumentation, laboratory test equipment, chemical feeders, valves, switching gear, and automatic controls.

#### 1.6.10.10. Wastewater Treatment Systems

Provide the identified information on the following equipment: tanks, unit process equipment, pumps, motors, control and monitoring instrumentations, laboratory test equipment chemical feeders, valves, scrapers, skimmers, comminutors, blowers, switching gear, and automatic controls.

#### 1.6.10.11. Fire Protection Systems

Provide information on the following equipment: alarm valves, manual valves, regulators, foam and gas storage tanks, piping materials, sprinkler heads, nozzles, pumps, and pump drivers.

#### 1.6.10.12. Fire Alarm and Detection Systems

(1) The maintenance manual shall include description of maintenance for all equipment, including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

(2) Provide all software; database with complete identification of programmable portions of system equipment and devices, and all other system programming data on all modes of the system; connecting cables; and proprietary equipment necessary for the operation, maintenance, testing, repair and programming, etc. of the system and that may be required for implementation of future changes to the fire system (additional and/or relocated initiating devices, notification devices, etc.

(3) Provide all system and equipment technical data and computer software with the requisite rights to Government use, in accordance with the applicable contract clauses.

(4) Training shall include software and programming required for the effective operation, maintenance, testing, diagnostics and expansion of the system.

#### 1.6.10.13. Plumbing Systems

Provide information on the following equipment: water heaters, valves, pressure regulators backflow preventors, piping materials, and plumbing fixtures.

#### 1.6.10.14. Liquid Fuels Systems

Provide information on the following equipment: tanks, automatic valves manual valves, filter separators, pumps, mechanical loading arms, nozzles, meters, electronic controls, electrical switch gear, and fluidic controls.

#### 1.6.10.15. Cathodic Protection Systems

Provide information on the following material and equipment: rectifiers, meters, anodes, anode backfill, anode lead wire, insulation material and wire size, automatic controls (if any), rheostats, switches, fuses and circuit breakers, type and size of rectifying elements, type of oil in oil-immersed rectifiers, and rating of shunts.

#### 1.6.10.16. Generator Installations

Provide information on the following equipment: generator sets, automatic transfer panels, governors, exciters, regulators starting systems, switchgear, and protective devices.

#### 1.6.10.17. Miscellaneous Systems

Provide information on the following: communication and ADP systems, security and intrusion alarm, elevators, material handling, active solar, photovoltaic, nurse call, paging, intercom, closed circuit TV, irrigation, sound and material delivery systems, kitchen, refrigeration, disposal, ice making equipment, and other similar type special systems not otherwise specified.

#### 1.6.10.18. Laboratory, Environmental and Pollution Control Systems

Provide information on the following equipment: wet scrubbers, quench chambers, scrub tanks, liquid oil separators, and fume hoods.

### 1.7. FIELD TRAINING

Field Training is a requirement for substantial completion. Conduct a training course for the operating staff for each particular system. Conduct the training is to be conducted during hours of normal working time after the system is functionally complete. The field instructions shall cover all of the items contained in the Equipment Operating, Maintenance and Repair Manuals. The training will include both classroom and "hands-on" training. Submit a lesson plan outlining the information to be discussed during training periods. Submit this lesson plan for approval 90 days before contract completion before the field training occurs. Record training on DVD and furnish to the Government within ten (10) days following training. Document all training and furnish a list of all attendees.

### 1.8. PRICING OF CONTRACTOR-FURNISHED AND INSTALLED PROPERTY AND GOVERNMENT-FURNISHED CONTRACTOR-INSTALLED PROPERTY

Promptly furnish and require any sub-contractor or supplier to furnish, in like manner, unit prices and descriptive data required by the Government for Property Record purposes of fixtures and equipment furnished and/or installed by the Contractor or sub-contractor, except prices do not need to be provided for Government-Furnished Property.

### 1.9. LEED REVIEW MEETINGS

1.9.1. Pre-Closeout Meeting. Approximately 30 days before submittal of LEED closeout documentation, the Contractor and the Government's project delivery team (including Installation representative) will meet to review the documentation, determine which, if any, credits will be audited and identify any corrections/missing items prior to the closeout LEED documentation submittal.

1.9.2. Approximately 14 days after submittal of LEED closeout documentation, the Contractor and the Government's project delivery team (including Installation representative) will meet to review the LEED closeout

documentation. The review conference will include discussion of and resolution of all review comments to ensure consensus on achievement of credits and satisfactory documentation. At the review conference a final score will be determined and endorsed in writing by all parties.

#### 1.10. RED ZONE MEETING

At approximately 80% of contract completion or 60 days before the anticipated Beneficial Occupancy Date (BOD), whichever occurs first, the Contractor and the Government's project delivery team will conduct what is known as the Red Zone Meeting to discuss the close-out process, to schedule the events and review responsibilities for actions necessary to produce a timely physical, as well as fiscal, project close-out. The Red Zone meeting derives its name from the football term used to describe the team effort to move the ball the last 20 yards into the end zone. The close-out of a construction project sometimes can be equally as hard and most definitely requires the whole team's efforts. The ACO will chair the meeting. If not already provided, shortly before the meeting, the Contractor shall provide an electronic copy or access to the CADD as-built drawings, completed commensurate with the amount of work completed at the time of the Red Zone Meeting, as an indicator of the Contractors' understanding of and ability to meet the USACE CADD Standards and to ensure that the Contractor is making progress with CADD As-Built requirements. EXHIBIT 1 is a generic meeting checklist.

#### 1.11. FINAL CLEANING

Clean the premises in accordance with FAR clause 52.236-12 and additional requirements stated here. Remove stains, foreign substances, and temporary labels from surfaces. Vacuum carpet and soft surfaces. Clean equipment and fixtures to a sanitary condition. Clean or replace filters of operating equipment if cleaning isn't possible or practicable. Remove debris from roofs, drainage systems, gutters, and downspouts. Sweep paved areas and rake clean landscaped areas. Remove waste, surplus materials, and rubbish from the site. Remove all temporary structures, barricades, project signs, fences and construction facilities. Submit a list of completed clean-up items on the day of final inspection.

#### 1.12. INTERIM FORM DD1354 "TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY

Near the completion of Project, but a minimum of 60 days prior to final acceptance of the work, complete, update draft provided with the final design package(s) (see Section 01 33 16, paragraph 3.7.5) and submit an accounting of all installed property on Interim Form DD1354 "Transfer and Acceptance of Military Real Property." Include any additional assets/improvements/alterations and cost updates from the Draft DD Form 1354. Contact the COR for any project specific information necessary to complete the DD Form 1354. This form will be a topic for the Red Zone Meeting discussed above. For information purposes, a blank DD Form 1354 (fill-able) in ADOBE (PDF) may be obtained at the following web site: <http://www.dtic.mil/whs/directives/infomgt/forms/eforms/dd1354.pdf> Submit the completed Checklist for Form DD1354 of Government-Furnished and Contractor-Furnished/Contractor Installed items. Attach this list to the updated DD Form 1354. Instructions for completing the form and a blank checklist (fill-able) in ADOBE (PDF) may be obtained at the following web site: [http://www.wbdg.org/ccb/DOD/UFC/ufc\\_1\\_300\\_08.pdf](http://www.wbdg.org/ccb/DOD/UFC/ufc_1_300_08.pdf)

EXHIBIT 1

**SAMPLE**

Red Zone Meeting Checklist

**Date:** \_\_\_\_\_

<b>Contract No.</b>	
<b>Description / Location</b>	
<b>Contractor</b>	
<b>Contracting Officer</b>	

<b>Action</b>	<b>Completion Milestone</b>	<b>√</b>
Inspections		
Fire		
Safety		
Pre-final		
Mechanical Test & Balance		
Commissioning		
Landscaping Complete		
Erosion Control		
Beneficial Occupancy Date (BOD)		
Furniture Installation		
Comm Installation		
As-Built Drawings		
Provide all O&M manuals, tools, shop drawings, spare parts, etc. to customer		
Training of O&M Personnel		
Provide Warranty documents to Customer		
Contract completion		

Ribbon cutting		
Payroll Clearances		
DD Form 2626 - Construction Contractor Performance Evaluation		
DD Form 2631 – A-E Performance Rated after Construction		
Status of Pending Mods and REA's/Claims		
Final Payment Completed		
Release of Claims		
Return of Unobligated Funds		
Move Project from CIP to General Ledger		
Financial completion		

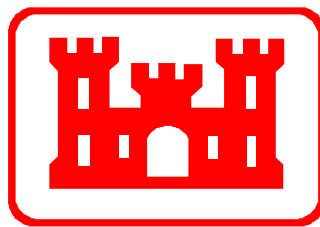
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**FORT HOOD, TEXAS**

**FAMILY LIFE CENTER**

**GOVERNMENT GEOTECHNICAL REPORT**

**FOR DESIGN-BUILD PROJECT RFP**



**PREPARED BY**

**U.S. ARMY CORPS OF ENGINEERS**

**FORT WORTH DISTRICT**

**ENGINEERING AND CONSTRUCTION DIVISION**  
**ENGINEERING BRANCH**

**GEOTECHNICAL SECTION**

**CESWF-EC-DG**

**MAY 2010**

Friday, June 18, 2010

**FORT HOOD, TEXAS  
FAMILY LIFE CENTER**

**GOVERNMENT GEOTECHNICAL REPORT**

**1. General.** The purpose of this report is to provide subsurface information, and foundation and pavement design considerations, guidance, and requirements for new Family Life Center at Fort Hood, Texas. A Multipurpose Activity Center (MPAC) will adjoin the Family Life Center. Design and construction of the new facilities will be accomplished under a design-build contract. It should be noted that the project facility descriptions provided herein are based on the DD 1391 document and other preliminary project design information available at the time of this report. The project includes an approximately 17,000 GSF, single-story Family Life Center and an approximately 10,000 GSF, two-story Multipurpose Activity Center, and appurtenant pavement structures. The Family Life Center will include an activity center, several classrooms, administrative areas, a kitchen, restrooms, storage rooms, and mechanical/electrical/communications equipment rooms. The Multipurpose Activity Center will include a large gymnasium/multipurpose room, youth lounge/interaction center areas, an arts and crafts area, administrative areas, restrooms, storage rooms, and mechanical/electrical/communications equipment rooms. Although details of the structural framing system, and other facility construction details, had not been established at the time of this report, it is anticipated that the new building construction will match existing building architectural styles of the surrounding area; refer to other sections of the RFP package for additional details concerning requirements for the facility design and construction. Minimum pavement sections are included in this report for fire/emergency medical vehicle access lanes and service drives, as well as privately-owned vehicle (POV) parking areas (if required for project, refer to Section 5.c.), and aprons in front of trash dumpster pads. These minimum sections shall be used where applicable, and where construction activity impacts require repairs/reconstruction of existing pavement structures of similar type. Support features include sidewalks, new utilities, landscaping, and site improvements.

The Family Life Center project site is located in the eastern part of the Fort Hood main cantonment. Specifically, the project site is located on a semi-developed parcel that is

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bounded to the north by Tank Battalion Avenue, to the east by 31<sup>st</sup> Street, to the south by Tank Destroyer Boulevard, and to the west by 37<sup>th</sup> Street. The Family Life Center and Multipurpose Activity Center will be situated in the southeastern quadrant of this area. A new Chapel and Religious Education Facility are under construction immediately south of the proposed Family Life Center project site at the time of this report. A new Child Development Center (0 – 5 Years) will be constructed immediately north-northwest of the proposed Family Life Center project site in the near future. Prior to construction of these Chapel and Religious Education Facility and Child Development Center, the project site was generally a cleared parcel. Based on information available as of this report, the Family Life Center project site currently is being used as a staging area for the Chapel and Religious Education Facility construction. Based on a recent topographic survey, existing elevations across the entire Family Life Center project site range from approximately 881.0 feet to 891.0 feet National Geodetic Vertical Datum (NGVD), sloping downgradient to the east at approximately a 2 to 4 percent slope across most of the site. Existing grades range from approximately 885.5 feet to 889.0 feet (NGVD) across the proposed Family Life Center building footprint. Existing grades range from approximately 883.5 feet to 886.0 feet (NGVD) across the proposed Multipurpose Activity Center building footprint. Finish floor elevations for these buildings were not known at the time of this report.

**2. Subsurface Investigation.** Due to site accessibility issues created by the on-going construction activities for the Chapel and Religious Education Facility, a site-specific geotechnical field investigation is pending for the Family Life Center at the time of this report. One or more test holes are scheduled to be drilled within the Family Life Center project limits. An amended Government Geotechnical Report will be issued when the geotechnical field investigation and laboratory testing programs have been completed. To supplement the geotechnical information that will be collected within the project limits, and to provide a basis for the foundation and pavement design considerations, guidance, and requirements provided herein, the results of the USACE geotechnical studies at the adjoining Chapel and Religious Education Facility and the Child Development Center (0 – 5 Years) are presented herein.



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Professional Services Industries, Inc. (PSI), through their drilling subcontractor, Gedco Drilling and Coring, Inc., drilled fourteen (14) test holes, 8A4C-CHAPEL-1 through 10A-CHAPEL-14, for the Chapel and Religious Education Facility site in January 2009 under a geotechnical drilling and sampling scope of work/contract administered by the U.S. Army Corps of Engineers, Fort Worth District. Test hole advancement and sample recovery was performed using 5- and 6-inch roller cone bits, a 4-inch (I.D.) carboloy bit core barrel sampler, and a nominal 3-inch diameter shelby tube sampler. Samples recovered from the borings were sealed in airtight containers and taken to the laboratory of TEAM Consultants, Incorporated (Arlington, Texas) for testing. The test holes were drilled to total depths ranging from 10.0 to 45.0 feet below existing grade. The PSI field investigation was performed using a Gardner-Denver 1000 truck-mounted drill rig and conventional drilling attachments. Results of the Chapel and Religious Education Facility field investigation are shown on the Chapel and Religious Education Facility Boring Locations sheet, B101, and on the Logs of Borings sheets, B201 through B205 (Appendix A).

Raba-Kistner Consultants, Inc., through their drilling subcontractor, Total Support Services, drilled thirteen (13) test holes for the Child Development Center (0 – 5 Years) project in January and February 2009 under a geotechnical drilling and sampling scope of work/contract administered by the U.S. Army Corps of Engineers, Fort Worth District. Specifically, borings 8A4C-CDC(FY10)-1 through 10A-CDC(FY10)-13 were drilled at the Child Development Center (0 – 5 Years) project site to determine subsurface conditions and to obtain representative soil and rock samples for laboratory testing. Test hole advancement and sample recovery was performed using an 8.25-inch (O.D.) flight auger, a 10.25-inch (O.D.; 8 5/8-inch I.D.) hollow stem continuous flight auger, and by a 4-inch (I.D.) core barrel sampler. Samples recovered from the boring were sealed in airtight containers and taken to the laboratory of TEAM Consultants, Incorporated (Arlington, Texas) for testing. The test holes were drilled to total depths ranging from 10.0 to 45.0 feet below existing grade. The field investigation was performed using a Mobile B-59 truck-mounted drill rig and conventional

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drilling attachments. Results of the Child Development Center (0 – 5 Years) field investigation are shown on Child Development Center (0 – 5 Years) Boring Locations sheet, B101, and on the Logs of Borings sheets, B201 and B203 (Appendix A).

a. Groundwater Conditions. Presented below are the groundwater conditions recorded during the geotechnical field investigations for the Chapel and Religious Education Facility and the Child Development Center (0 – 5 Years). It should be noted that groundwater conditions are relative to the time of drilling, annual precipitation, and drainage conditions at the site.

(1) Chapel and Religious Education Facility. Groundwater conditions were monitored during drilling operations immediately upon completion of the test holes, and after an observation period of up to 24 hours. Static water levels were measured in eleven of the eighteen borings drilled during the U.S. Army Corps of Engineers field investigation, with depths ranging from 11.6 to 30.5 feet, and in four of the fourteen borings drilled during the PSI field investigation, with depths ranging from 35.8 feet to 40.5 feet below existing grade. Tabulated below are the static levels measured at the time of the field investigation.

<u>Boring</u>	<u>Static Level, feet</u>
8A4C-CHAPEL-1	29.0
8A4C-CHAPEL-2	11.0
8A4C-CHAPEL-3	40.5
8A4C-CHAPEL-4	39.0
8A4C-CHAPEL-5	25.0

(2) Child Development Center (0 – 5 Years). Groundwater conditions were monitored during drilling operations and immediately upon completion of the test holes. Groundwater was measured at a depth of 21 feet in boring 8A4C-CDC(FY10)-4. The remaining ten borings were dry at these times.

b. Dynamic Cone Penetrometer Testing. Dynamic Cone Penetrometer testing (DCP) was performed for pavement design considerations at the Chapel and Religious Education Facility project site in borings 10A-CHAPEL-6, 10A-CHAPEL-7, 10A-CHAPEL-8, 10A-

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CHAPEL-9, and 10A-CHAPEL-13 during the field investigation. Dynamic Cone Penetrometer testing (DCP) was performed for pavement design considerations at the Child Development Center (0 – 5 Years) project site in borings 10A-CDC(FY10)-6, 10A-CDC(FY10)-7, 10A-CDC(FY10)-8, 10A-CDC(FY10)-9, 10A-CDC(FY10)-10, 10A-CDC(FY10)-11, 10A-CDC(FY10)-12, and 10A-CDC(FY10)-13. Results of DCP testing are presented in Appendix D and discussed in Sections 4 and 5.

c. Soil Resistivity Testing. Soil resistivity testing at the Chapel and Religious Education Facility project site was performed during the field investigation at the approximate location of boring 8A4C-CHAPEL-3. The resistivity values measured in the field (in north-south and east-west alignments) at the location of boring 8A4C-CHAPEL-4 are presented on the log of boring (Appendix A). It should be noted that the resistivity values presented above for boring 8A4C-CHAPEL-4 are anomalously very low compared to typical resistivity values measured at Fort Hood.

Soil resistivity testing at the Child Development Center (0 – 5 Years) project site was performed at a location approximately midway between borings 8A4C-CDC(FY10)-4 and 10A-CDC(FY10)-7. The resistivity values measured in the field (in north-south and east-west alignments) are as follows:

<u>Diode Spacing (Test Depth), feet</u>	<u>Field Soil Resistivity, ohm-cm</u>	
	<u>N-S</u>	<u>E-W</u>
2.5	1,638	1,234
5.0	1,252	1,366
7.5	1,399	1,304
10.0	1,432	1,387

### 3. Subsurface Conditions.

a. General Geology. Fort Hood lies within the Central Texas Section of the Great Plains physiographic province. The topographic features of the area are those of a dissected plateau characterized by buttes and mesas. Approximately 30 miles southeast of Fort Hood, the dissected plateau topography gives way to the moderate or rolling relief of the Gulf Coastal

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Plain. The Balcones fault zone is, roughly, the dividing line of the two physiographic provinces. The uppermost primary stratum underlying Fort Hood is the Walnut Formation of the Comanche Series, Cretaceous age. The Walnut Formation is composed of gray-black, calcareous clay shales alternating with beds of chalky, nodular limestone and shell conglomerates. The entire Walnut Formation was not penetrated by borings drilled at the site.

Overburden soils within the area vary from a knife edge to greater than 30 feet in thickness, and consist of clays of low to high plasticity, clayey gravels and/or clay choked limestone nodules. The overburden soils are residual soils derived from the underlying parent material.

b. Site Conditions. Prior to construction of the Chapel and Religious Education Facility and Child Development Center (0 to 5 Years), the project site was generally a cleared parcel. Based on information available as of this report, the Family Life Center project site currently is being used as a staging area for the Chapel and Religious Education Facility construction. Based on a recent topographic survey, existing elevations across the entire Family Life Center project site range from approximately 881.0 feet to 891.0 feet National Geodetic Vertical Datum (NGVD), sloping downgradient to the east at approximately a 2 to 4 percent slope across most of the site. Existing grades range from approximately 885.0 feet to 889.0 feet (NGVD) across the proposed Family Life Center building footprint. Existing grades range from approximately 881.0 feet to 885.0 feet (NGVD) across the proposed Multipurpose Activity Center building footprint. Finish floor elevations for these buildings were not known at the time of this report.

Presented below are discussions regarding the subsurface conditions identified in the test holes drilled during the respective geotechnical field investigations at the adjoining Chapel and Religious Education Facility and Child Development Center (0 – 5 Years) sites. Based on these studies and numerous other engineering studies performed at Fort Hood by USACE, Fort Worth District during the past five decades, the subsurface conditions within the proposed Family Life Center project limits are anticipated to be very similar to those encountered during

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the adjoining project geotechnical field investigations. As previously stated, one or more borings will be drilled within the Family Life Center project limits, and the subsurface information and laboratory testing data will be issued subsequently an amended Government Geotechnical Report.

(1) Chapel and Religious Education Facility Site. Stratigraphically, the site is characterized by low to high plasticity clay overburden (CL to CH, respectively), underlain by strata of weathered marl/shale primary and weathered limestone primary. Based upon the information provided on the logs of borings, the results of laboratory testing, and experience with the subsurface materials at Fort Hood, the medium to high plasticity clay overburden is a weathering product of the limestone and marl/shale primary. As shown on the logs of borings, seams of extremely weathered limestone are present within the low to high plasticity overburden clay, which varies in thickness from 7.2 feet to 12.3 feet at the boring locations. Furthermore, based on the results of laboratory testing, experience with the subsurface materials at Fort Hood, and engineering judgment, the overburden materials are more typically brown to dark brown and high plasticity; however, due to weathering, and likely drilling and sampling techniques used during the field investigation, highly weathered limestone and marl/shale materials have become mixed with the highly plastic overburden clays, reducing their plasticity characteristics in the case of some specimens. Consequently, the highly weathered interbedded marl/shale and limestone primary is likely present much closer to the surface than defined stratigraphically on the logs of borings (but can be correlated by the presence of weathered limestone seams within strata described as clay overburden). The low to high plasticity clay overburden is hard, dry to moist, brown to light brown to yellow brown, with gravel and sand (limestone fragments). Liquid limits measured from representative samples of the low to high plasticity clay overburden collected from the site range from 31 to 95 percent, plastic limits vary from 14 to 28 percent (with plasticity indices ranging from 13 to 70 percent), and in situ moisture contents vary between 4 and 25 percent.

Strata of weathered marl/shale primary or weathered limestone primary underlie the

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overburden clays. The weathered marl/shale primary stratum is described on the logs of borings as being moderately hard. However, this description is interpreted as considering the marl/shale as a clay (consistency) material. Based on previous engineering studies at Fort Hood, the marl/shale stratum is very soft to soft (Rock Classification). The marl/shale stratum is dry to slightly moist, yellow brown, and is interbedded with seams of limestone (hard, Rock Classification) and includes shell fossils. Based on previous engineering studies at Fort Hood, the marl shale typically has a characteristic blocky structure, and is jointed and fractured. The thickness of the weathered marl/shale primary stratum, where encountered and penetrated in its entirety, ranges from 2.8 to 7.1 feet at the boring locations (wherein the underlying weathered limestone stratum was penetrated). Specimens of the marl/shale primary subjected to Atterberg limits testing were found to have liquid limits ranging from 32 to 59 percent, plastic limits ranging from 15 to 20 percent (with plasticity indices ranging from 16 to 39 percent), and in situ moisture contents varying from about 7 to 16 percent.

These overburden clay and weathered marl/shale strata are underlain by a stratum of weathered limestone. The weathered limestone is encountered at depths ranging from 14.8 to 18.3 feet below existing grade. The weathered limestone stratum is described as yellow brown to gray to light gray, moderately hard to very hard (Rock Classification), interbedded with seams of soft (Rock Classification) marl/shale, with shell fossils. It should be noted that the weathered limestone is jointed and fractured throughout. The limestone is described as becoming less weathered at depths greater than 23.6 feet to 26.3 feet below existing grade to the total depth investigated (45.0 feet) at the boring locations (although it should be noted that dark gray unweathered limestone was not identified within the borings).

(2) Child Development Center (0 – 5 Years) Site. The following subsurface material descriptions are based on the descriptions of the materials provided by the drilling subcontractor on the logs of borings, the laboratory testing data, and experience with the subsurface materials at Fort Hood. Based on these considerations, the project site is characterized by an upper overburden soil layer, typically 5 feet or less in thickness, consisting

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of high plasticity dark brown clay with limestone fragments. This high plasticity clay is likely a residual soil developed by extreme weathering of the underlying limestone and marl primary. Liquid limits measured from representative specimens of the residual clayey soils range from 76 to 87 percent, plastic limits vary from 25 to 27 percent (with plasticity indices ranging from 51 to 60 percent), and in situ moisture contents vary between 20 and 23 percent.

Based upon the information provided on the logs of borings, the results of laboratory testing, and experience with the subsurface materials at Fort Hood, the uppermost primary stratum consists of highly weathered limestone that is interbedded with highly weathered to weathered marl/shale. The marl/shale is very soft to soft (Rock Classification) (based on experience), and is yellow brown to gray. Due to the apparent drilling and sampling techniques used, collected specimens of the highly weathered to weathered marl/shale were given a USCS classifications in the laboratory ranging from low to high plasticity clay (CL to CH, respectively); this variation in classifications is most likely a function of the proportion of limestone, ground up by drilling action, present in the sample. Liquid limits measured from representative specimens of the highly weathered to weathered marl/shale range from 23 to 76 percent, plastic limits vary from 15 to 23 percent (with plasticity indices ranging from 8 to 54 percent), and in situ moisture contents vary between 11 and 24 percent.

Based on the information presented on the logs of borings, the contact of the overburden clay with the highly weathered to weathered limestone and marl/shale primary is present at depths ranging from approximately 2 to 5 feet below existing grade at the project site. The limestone is mostly hard to very hard (Rock Classification) (based on experience), and is light gray to gray to dark gray. The limestone is noted as becoming less weathered (moderately weathered) at depths ranging from 20.0 to 31.0 feet below existing grade at the boring locations.

Subsurface conditions representative of the Chapel and Religious Education Facility project site are shown on the Chapel and Religious Education Facility logs of borings, Sheets B201 through B205 (Appendix A). Subsurface conditions representative of the Child

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Development Center (0 – 5 Years) project site are shown on the Child Development Center (0 – 5 Years) logs of borings, Sheets B201 and B203 (Appendix A). The legend on the individual boring logs show overburden materials as classified in the laboratory using procedures presented in ASTM D 2488. It should be noted that the actual interface between material types may be far more gradual or abrupt than presented; therefore, actual subsurface conditions in areas not sampled may differ from those predicted. The nature and extent of variations across the sites may not become evident until construction commences, and the actual construction process may alter subsurface conditions as well. If variations become evident at the time of construction, CESWF-EC-DG should be contacted to determine if the recommendations presented in this report need to be reevaluated.

**4. Testing.**

a. Laboratory Testing. Representative soil and rock samples recovered from selective test holes were subjected to laboratory testing for identification, moisture content, grain-size distribution, Atterberg limits, density, strength, and controlled expansion-consolidation. The accumulative test results are tabulated and presented in Appendix C. Results of identification and moisture content testing are shown on the boring logs, Appendix A.

Results of laboratory testing performed on samples obtained from the Chapel and Religious Education Facility site and the Child Development Center (0 – 5 Years) site are presented graphically (by respective project site) in Appendix B as follows: Plasticity characteristics are shown on Plate 1, Plasticity Chart. Moisture content values of representative samples are shown with respect to depth on Plate 2. Atterberg limits test results are shown with respect to depth on Plate 3. Dry density values of representative undisturbed samples and their corresponding moisture contents are shown with respect to depth on Plate 4. Ultimate compressive strengths of the limestone primary are shown with respect to depth on Plate 5. Testing results for the Chapel and Religious Education Facility site are denoted with an “a” suffix after the plate number (e.g., Plate 1a), while testing results for the Child Development Center (0 – 5 Years) are denoted with a “b” suffix after the plate number (e.g.,



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Plate 1b).

(1) Shear Strength Testing. Shear strength characteristics of the limestone primary were analyzed in the laboratory using unconfined compression (UC) testing. Tabulated below are the ultimate compressive strengths and respective dry densities. Shear strength test results are presented in Appendix C at the end of this report.

Chapel and Religious Education Facility Site

<u>Boring</u>	<u>Depth, feet</u>	<u><math>\gamma_d</math>, pcf</u>	<u><math>Q_u</math>, tsf</u>	<u>Material Type</u>
8A4C-CHAPEL-1	17.5	130.4	10.31	Weathered Limestone
8A4C-CHAPEL-1	24.1	123.9	63.38	Weathered Limestone
8A4C-CHAPEL-1	29.6	131.1	74.03	Weathered Limestone
8A4C-CHAPEL-1	30.4	138.7	49.29	Weathered Limestone
8A4C-CHAPEL-1	39.6	135.0	62.79	Weathered Limestone
8A4C-CHAPEL-1	42.8	124.5	55.73	Weathered Limestone
8A4C-CHAPEL-2	18.4	125.2	48.76	Weathered Limestone
8A4C-CHAPEL-2	23.9	130.1	24.83	Weathered Limestone
8A4C-CHAPEL-2	27.0	135.5	36.40	Weathered Limestone
8A4C-CHAPEL-2	32.7	135.9	62.75	Weathered Limestone
8A4C-CHAPEL-2	38.4	135.5	79.60	Weathered Limestone
8A4C-CHAPEL-2	41.3	135.3	29.28	Weathered Limestone
8A4C-CHAPEL-3	24.5	140.3	33.94	Weathered Limestone
8A4C-CHAPEL-3	28.4	127.9	100.67	Weathered Limestone
8A4C-CHAPEL-3	34.0	130.9	118.79	Weathered Limestone
8A4C-CHAPEL-3	39.6	137.0	34.53	Weathered Limestone
8A4C-CHAPEL-3	43.8	137.6	24.91	Weathered Limestone
8A4C-CHAPEL-4	16.7	138.1	66.92	Weathered Limestone
8A4C-CHAPEL-4	23.9	127.2	98.55	Weathered Limestone
8A4C-CHAPEL-4	26.9	130.7	116.52	Weathered Limestone
8A4C-CHAPEL-4	31.1	138.9	62.12	Weathered Limestone
8A4C-CHAPEL-4	39.6	129.5	93.07	Weathered Limestone
8A4C-CHAPEL-4	40.8	133.8	126.53	Weathered Limestone
8A4C-CHAPEL-5	19.0	127.2	104.86	Weathered Limestone
8A4C-CHAPEL-5	23.3	131.4	96.33	Weathered Limestone
8A4C-CHAPEL-5	28.2	135.3	19.51	Weathered Limestone
8A4C-CHAPEL-5	34.1	126.6	112.17	Weathered Limestone
8A4C-CHAPEL-5	38.1	133.0	58.56	Weathered Limestone
8A4C-CHAPEL-5	43.4	134.5	32.69	Weathered Limestone

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Child Development Center (0 – 5 Years) Site

<u>Boring</u>	<u>Depth, feet</u>	<u><math>\gamma_d</math>, pcf</u>	<u><math>Q_u</math>, tsf</u>	<u>Material Type</u>
8A4C-CDC(FY10)-1	33.3	139.0	53.8	Weathered Limestone
8A4C-CDC(FY10)-2	23.5	122.3	59.1	Weathered Limestone
8A4C-CDC(FY10)-2	27.5	128.8	101.3	Weathered Limestone
8A4C-CDC(FY10)-2	31.5	135.7	47.9	Weathered Limestone
8A4C-CDC(FY10)-2	34.0	132.3	17.8	Weathered Limestone
8A4C-CDC(FY10)-2	35.5	137.9	46.5	Weathered Limestone
8A4C-CDC(FY10)-2	42.5	137.1	50.3	Weathered Limestone
8A4C-CDC(FY10)-3	38.5	139.5	44.3	Weathered Limestone
8A4C-CDC(FY10)-4	33.5	128.3	55.7	Weathered Limestone
8A4C-CDC(FY10)-4	38.5	135.6	36.0	Weathered Limestone
8A4C-CDC(FY10)-4	41.9	131.8	11.4	Weathered Limestone
8A4C-CDC(FY10)-5	34.1	133.4	97.9	Weathered Limestone
8A4C-CDC(FY10)-5	39.8	138.4	100.8	Weathered Limestone
8A4C-CDC(FY10)-5	44.3	137.5	38.6	Weathered Limestone

(2) Controlled Expansion-Consolidation Testing and Swell Pressure Testing.

Controlled expansion-consolidation (CEC) testing was performed on one specimen of high plasticity (CH) clay overburden collected at the Chapel and Religious Education Facility site. The high plasticity (CH) clay overburden specimen was collected at a depth of 0.5 feet within boring 8A4C-CHAPEL-3. This high plasticity clay specimen has a liquid limit of 53 percent, a plastic limit of 21 percent ( $PI = 32$  percent), and natural moisture content of approximately 17 percent. An expansion pressure ( $p_{exp}$ ) of approximately 0.75 tsf was recorded during CEC testing of the high plasticity clay specimen. Based on CEC test results, the high plasticity clay specimen collected at a depth of 0.5 feet within boring 8A4C-CHAPEL-3 has a moderate to high expansion potential ( $C_s = 0.030$ ;  $p_{exp}/p_0 = 26.0$ ) and a moderate to high consolidation potential ( $C_c = 0.220$ ). Controlled expansion-consolidation test results are summarized in the table below and presented in Appendix C at the end of this report.

Controlled Expansion-Consolidation Test

<u>Boring</u>	<u>Depth, feet</u>	<u>LL &amp; PI</u>		<u><math>P_{exp}/P_0</math></u>	<u><math>C_s</math> &amp; <math>C_c</math></u>		<u>Material Type</u>
8A4C-CHAPEL-3	0.5	53	32	26.0	0.030	0.220	CH Clay Overburden

b. Field Testing. Dynamic Cone Penetrometer testing (DCP) was performed for

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pavement design considerations at the Chapel and Religious Education Facility project site in borings 10A-CHAPEL-6, 10A-CHAPEL-7, 10A-CHAPEL-8, 10A-CHAPEL-9, and 10A-CHAPEL-13 during the field investigation. Dynamic Cone Penetrometer testing (DCP) was performed for pavement design considerations at the Child Development Center (0 – 5 Years) project site in borings 10A-CDC(FY10)-6, 10A-CDC(FY10)-7, 10A-CDC(FY10)-8, 10A-CDC(FY10)-9, 10A-CDC(FY10)-10, 10A-CDC(FY10)-11, 10A-CDC(FY10)-12, and 10A-CDC(FY10)-13. A DCP consists of a steel rod with a steel cone attached to one end and a sliding single-mass hammer. For the Chapel and Religious Education Facility project and the Child Development Center (0 – 5 Years) project, the DCP test was performed by driving the steel cone into the soil using a 17.6-pound sliding hammer dropped from a height of 22.6 inches (574 millimeters). The number of blows required for each 0.4 inch (10-mm) or higher of penetration was recorded as the "penetration per blow set"; therefore, the more penetration achieved per blow indicates that a "weaker" soil layer was encountered. Typically, penetration measurements are taken to a depth of 39.4 inches (1,000 millimeters) or when refusal is achieved. Refusal is defined as the point when the cone cannot penetrate the soil more than 0.4 inches (10 millimeters). Presented below are the average in situ strength parameters derived from the DCP tests, by project site. DCP test results are also presented in Appendix D at the end of this report.

Chapel and Religious Education Facility Site

<u>Depth, in</u>	<u>CBR, %</u>	<u>k, pci</u>
0 – 6	13 - 21	230 - 263
6 – 12	17 - 43	269 - 364
>12	14 - 70	233 - 438

Child Development Center (0 – 5 Years) Site

<u>Depth, in</u>	<u>CBR, %</u>	<u>k, pci</u>
0 – 6	2 - 13	70 - 238
6 – 12	2 - 19	75 - 268
>12	1 - 93	60 - 492

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**5. Discussions.** The following discussions are provided in support of the foundation and pavement design recommendations and requirements made herein for the proposed Family Life Center and appurtenant pavement structures. It should be noted that the discussions presented herein are based on the results of the Government geotechnical field investigation and laboratory testing program conducted at the site, as described previously in this report, as well as engineering studies, and previous engineering experience with similar structures at Fort Hood. The Design-Build Contractor shall heed the information provided in this report and comply with the requirements and recommendations presented herein when developing his or her foundation and pavement designs. **The Design-Build Contractor's foundation and**

**pavement designs are required to comply with and to meet or exceed the minimum foundation and pavement design requirements and recommendations presented herein.**

The bidders for this design-build contract project may use the subsurface boring log and lab testing data presented herein as a basis to formulate his or her foundation and pavement designs for the purposes of developing a bid for the project Request for Proposal (RFP) solicitation. However, the successful Design-Build Contractor shall supplement the information provided herein by his or her own geotechnical field investigation and laboratory testing program for the purpose of supplementing and comparing with the data provided in this report, verification of the stratigraphic contacts within design building footprints, and to serve as a basis for the development of his or her final foundation and pavement designs.

**Supplemental geotechnical field investigations conducted by the Design-Build Contractor shall be ONLY for the purpose of supplementing the data regarding the subsurface conditions provided by the Government geotechnical field investigation.** These

supplemental efforts shall include conducting testing on soil and rock specimens as described in Section 4 (Testing). A minimum of **four (4)** additional test holes shall be drilled within the design building footprint for the Family Life Center and a minimum of **two (2)** additional test holes shall be drilled within the design building footprint for the Multipurpose Activity Center. A minimum of **four (4)** additional test holes shall be drilled in areas of new pavement structure

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construction. Additional test holes for foundation design shall each be drilled to a minimum depth of 45 feet below existing grade, and additional test holes drilled for pavement design shall be drilled to a minimum depth of 10 feet below existing grade. Tests on disturbed specimens of overburden soils shall include classification (ASTM D 2488), moisture content (ASTM D 2216), grain size analysis (ASTM D 422), and Atterberg limits (ASTM D 4318). Undisturbed (shelby tube) specimens of the overburden soils shall also be collected in any supplemental geotechnical field investigations; tests on undisturbed specimens of the overburden soil shall include the tests listed for disturbed specimens, as well as controlled expansion-consolidation testing (ASTM D 2435 and ASTM D 4546 (Method C)), density (Corps of Engineers Engineer Manual (EM) 1110-2-1906, Appendix II, Par. 4, Displacement Method), and strength testing (ASTM D 2850). Core specimens of at least 4-inch diameter of the weathered marl/shale and limestone primary shall be collected and subjected to testing to include moisture content (ASTM D 2216), Atterberg limits (ASTM D 4318), density (Corps of Engineers EM 1110-2-1906, Appendix II, Par. 4, Displacement Method), controlled expansion-consolidation (for marl/shale core specimens) (ASTM D 2435 and ASTM D 4546 (Method C)), and strength (ASTM D 2464 for marl/shale core specimens; ASTM D 2938 for limestone core specimens).

***Development of the final foundation and pavement designs is the responsibility of the Design-Build Contractor; however, the Design-Build Contractor's final foundation and pavement designs shall be in full compliance with the requirements prescribed herein (including foundation type, foundation design parameters, and minimum pavement sections and pavement design criteria and parameters).***

The Design-Build Contractor shall provide to the Government engineering studies and design calculations that support the foundation and pavement design recommendations they or their associates propose. The Design-Build Contractor's foundation and pavement design recommendations shall be reviewed for technical adequacy and compliance with the requirements and criteria established herein and in the Request for Proposal (RFP). Specific requirements for the Design-Build Contractor's

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foundation and pavement design analysis are provided in section 6.c.

a. Soil Activity Considerations. The following expansive soils analysis considers data from the geotechnical field investigations performed at the adjacent Chapel and Religious Education Facility and Child Development Center (0 – 5 Years) project sites, as well as data from previous USACE, Fort Worth District engineering studies. The Chapel and Religious Education Facility and Child Development Center (0 – 5 Years) project sites are characterized by a low to high plasticity clay residual soil overburden stratum that is underlain by a marl/shale primary stratum (with low to high plasticity clay plasticity characteristics) and by a formation of weathered limestone. Seams of limestone near the surface (i.e., especially in the upper 10 feet) are extremely weathered and are interbedded with numerous low to high plasticity clay (residual soil) and marl/shale seams. At the Chapel and Religious Education Facility site, liquid limits measured from representative specimens of the residual clayey overburden soils and marl/shale primary within the upper 15 feet range from 31 to 95 percent, plastic limits vary from 14 to 28 percent (with plasticity indices ranging from 13 to 70 percent), and in situ moisture contents vary between 4 and 25 percent. These strata are considered to be moisture deficient to at least the contact with the weathered limestone stratum, and within the active zone (which at this site extends to a depth of approximately 15 to 20 feet, based on the results of Atterberg limits and moisture content testing).

At the Child Development Center (0 – 5 Years) project site, the overburden clays are typically 5 feet or less in thickness at the locations of the test holes drilled during the geotechnical field investigation. Liquid limits measured from representative specimens of the residual clayey overburden soils range from 76 to 87 percent, plastic limits vary from 25 to 27 percent (with plasticity indices ranging from 51 to 60 percent), and in situ moisture contents vary between 20 and 23 percent. The uppermost part of the limestone primary stratum, in approximately the upper 20 to 31 feet is highly weathered and interbedded with seams of marl/shale. Liquid limits measured from representative specimens of the highly weathered to weathered marl/shale range from 23 to 76 percent, plastic limits vary from 15 to 23 percent

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(with plasticity indices ranging from 8 to 54 percent), and in situ moisture contents vary between 11 and 24 percent. Based on the results of laboratory testing on specimens of the highly plastic clay and marl/shale primary, and on the results of previous engineering studies at Fort Hood, the active zone at this site extends to a depth of approximately 20 feet below existing grade. Although moisture contents are wide-ranging within the active zone, moisture content and Atterberg limits test results indicate that overburden soils and marl/shale are potentially moisture deficient throughout.

Based on the results of controlled expansion-consolidation testing conducted on a specimen of CH clay collected at the Chapel and Religious Education Facility site (as discussed above in Paragraph 4.a.(2)), the high plasticity clay overburden has a moderate to high expansion potential and a moderate to high consolidation potential. Based on previous engineering studies at Fort Hood, the weathered marl/shale primary has a moderate to high expansion potential and a moderate to high consolidation potential. Based on the results of current and previous controlled expansion-consolidation testing previously performed on the high plasticity clayey overburden soils, previous CEC testing performed on the weathered marl/shale, and engineering judgment, the heave potential of the highly plastic clayey overburden soils and the weathered marl/shale primary is anticipated to be between approximately 2 and 4 inches.

Special foundation and subgrade preparation requirements for the Family Life Center are provided herein to ensure the structures withstand the effects of the high shrink-swell subsurface conditions.

b. Foundation Design Considerations. The foundation design recommendations and requirements presented in this report are based on criteria contained in *UFC 3-220-03FA*, *UFC 3-220-07*, and engineering judgment.

The proposed Family Life Center is anticipated to be a single-story structure, while the adjoining Multipurpose Activity Center is anticipated to be a two-story structure which will include a large open area (gymnasium). Column loads are anticipated to be light to moderate

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for both structures. Based on the anticipated size, layout, and functional requirements of the new facilities, as well as the site-specific subsurface conditions present, a reinforced concrete straight-shaft drilled pier foundation system is considered the best-suited foundation system for the new buildings. Reinforced concrete straight-shaft piers have proven to be a highly successful foundation system at Fort Hood. Reinforced concrete underreamed piers, however, are not considered to be a viable deep foundation system. This is due to the difficulty in constructing the underream within the hard limestone primary. Also, the limestone primary can be assigned an allowable bearing capacity large enough that pier underreams are not considered warranted to support the anticipated magnitude of column loads distributed to the pier foundations.

Alternatively, the best shallow foundation performance by similar structures in the expansive subsurface material conditions present at Fort Hood has been achieved by two types of shallow foundation systems: a reinforced concrete ribbed mat slab and a reinforced concrete flat mat slab. These two shallow foundation systems, when properly designed and constructed, will act monolithically when subjected to shrink-swell movements of the subsurface materials, in contrast to other, unsuitable shallow foundation systems such as spot and continuous spread footings. A disadvantage of slab foundations is that to incorporate adequate monolithic behavior, yet minimize stress concentrations induced by irregular building geometries, additional stiffness at corners and isolation of slab units is needed to limit deflections to tolerable limits not affecting the facade and interior wall/ceiling finishes. Such irregular geometries often yield stress induced cracks in gypboard and CMU walls and create separations at wallbond ceiling joints. Therefore, slab designs should incorporate appropriate stiffness and isolation measures. It should be noted that it is anticipated that a flat mat slab foundation system would be more easily adaptable to the somewhat irregular building footprint geometries presented elsewhere in the RFP.

Therefore, the foundation system used for the proposed Family Life Center and adjoining Multipurpose Activity Center shall be limited to either a deep foundation system



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consisting of reinforced concrete straight-shaft piers, or a shallow foundation system consisting of either a monolithic reinforced concrete ribbed mat or flat mat slab, designed in accordance with the criteria and minimum requirements specified herein. Of these three permissible foundation systems, the reinforced concrete straight-shaft drilled pier foundation system is recommended over the two mat foundation system options, for the reasons discussed above. ***IT IS REQUIRED THAT ALL FOUNDATION, FLOOR SLAB, AND EARTHWORK***

***DESIGNS AND CONSTRUCTION BY THE DESIGN-BUILD CONTRACTOR AND THEIR ASSOCIATES SHALL COMPLY WITH THE MINIMUM REQUIREMENTS PRESENTED HEREIN.***

c. Pavement Design Considerations. The pavement designs presented in this report are based on criteria contained in *UFC 3-250-01FA*, *UFC 3-250-18FA*, and engineering judgment.

(1) Traffic Types and Conditions. Four (4) pavement structures were analyzed and designed for this project. Specifically, pavement structures required for this project include fire/emergency medical vehicle access lanes, service drives, privately-owned vehicle (POV) parking area(s), and concrete aprons in front of trash dumpster pads. At the time of this report, it is the understanding of CESWF-EC-DG that either rigid or flexible pavement structures may be utilized for the fire/emergency medical vehicle access lanes, service drives, and POV parking area(s). Therefore, alternative rigid and flexible minimum pavement designs are provided herein for those structures. Fire/emergency medical vehicles and trash trucks (i.e., Category IVA vehicles) will occupy the fire/emergency medical vehicle access lane and service drives, while the types of vehicles to occupy the POV parking area(s) are anticipated to be limited to passenger cars and trucks (i.e., Category II vehicles). The POV parking area(s) for the Family Life Center are anticipated to accommodate a frequency of Category II vehicles equivalent to street Class E (i.e., greater than 25 passes but less than 250 passes within a one-hour interval). It should be noted that it is anticipated that there will be exchange and overlap of POV traffic between the Family Life Center, the Chapel and Religious Education Facility, and the Child Development Center (0 – 5 Years). Based on criteria contained in the

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aforementioned United Facilities Criteria, the following traffic conditions were assigned:

<u>Pavement Structure</u>	<u>Traffic Category</u>	<u>Street Class</u>	<u>Design Index</u>
Emergency Access Lane/ Service Drives	IVA	F	4
Apron (Trash)	IVA	F	4
POV Parking Areas	II	E	2

(2) Pavement Design Parameters. California Bearing Ratio (CBR) and plate bearing tests were not performed for this project. Instead, dynamic cone penetrometer (DCP) testing was conducted to evaluate the raw subgrade for pavement design considerations. The penetration resistance obtained from the DCP test is a measure of the soil's relative density, which in turn is used to derive "in situ" CBR and modulus of subgrade reaction values.

The average in situ CBR values measured within the upper 12 inches of soils tested across the Chapel and Religious Education Facility site range from approximately 13 to 43 percent, and below this depth, CBR values ranging from 14 to 70 were recorded. Modulus of subgrade reaction values measured within the upper 12 inches of soils tested across the Chapel and Religious Education Facility site range from 230 to 364 pci, and below this depth, modulus of subgrade reaction values ranging from 233 to 438 were recorded. The average in situ CBR values measured within the upper 12 inches of soils tested at the Child Development Center (0 – 5 Years) site range from approximately 2 to 19 percent, and below this depth, CBR values ranging from 1 to 93 were recorded. Modulus of subgrade reaction values measured within the upper 12 inches of soils tested at the Child Development Center (0 – 5 Years) site range from 70 to 268 pci, and below this depth, modulus of subgrade reaction values ranging from 60 to 492 were recorded. In the past, the clayey subgrade at Fort Hood has been assigned CBR values ranging from 4 to 6 percent when compacted to 90 percent of laboratory maximum density. Previously conducted plate-bearing tests indicate that modulus of subgrade reaction values on the order of 100 pci to 150 pci can be assigned to the in situ soils when compacted to 90 percent of laboratory maximum density. The CBR and subgrade modulus values determined

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from in situ DCP testing are variable and range higher than the historical CBR and subgrade modulus values described above (with the exception of the DCP test performed at the location of boring 10A-CDC(FY10)-7, where correlated CBR and subgrade modulus values were equal to or less than the historical values). This is believed to be due to the presence of gravel (extremely weathered limestone) at and near the surface at the DCP test locations. It should also be noted that the DCP tests were conducted during a period of severe, protracted drought conditions. Consequently the near surface soils were highly desiccated and hard at the time of the tests; it is anticipated that the apparent strength of these soils would be significantly lower if their in situ moisture content was increased (e.g., through precipitation, inadequate drainage, etc.). Based on these considerations, and the potential that some pavement sections may be built in fill sections, design CBR and modulus of subgrade reaction values of 4 percent and 100 pci, respectively, were assigned to the raw subgrade when compacted to 90 percent of laboratory maximum density (ASTM D 1557).

(3) Material Sources. Material sources in central Texas are capable of producing a high quality crushed aggregate for concrete mixes to meet strength requirements. For this reason, a concrete flexural strength of 650 psi at 28 days was considered in the design of rigid pavements. To date, Alkali/Silica Reaction with Portland Cement Concrete has never been a problem when using local aggregate sources.

**6. Recommendations and Requirements.** The following foundation and pavement design recommendations and requirements are based on results of the field investigation, laboratory testing, and engineering studies.

a. Foundation Design Recommendations and Requirements.

(1) Foundation System. Only the following foundation systems shall be allowed for the Family Life Center and Multipurpose Activity Center: 1) reinforced concrete straight-shaft drilled piers (recommended), 2) a reinforced concrete ribbed mat slab, or 3) a reinforced concrete flat mat slab, designed in accordance with the criteria and minimum requirements specified herein. **NO OTHER FOUNDATION SYSTEMS SHALL BE**

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**ALLOWED. THE FOLLOWING FOUNDATION SYSTEMS ARE SPECIFICALLY PROHIBITED: SPOT AND/OR CONTINUOUS SPREAD FOOTINGS AND AUGER CAST PILES.**

(a) Reinforced Concrete Straight-Shaft Drilled Piers. The following foundation system design requirements are provided for reinforced concrete straight-shaft drilled piers. **The foundation design and construction must comply with the minimum requirements specified herein.**

Based on shear strength testing results, straight-shaft piers shall be founded at a depth of at least 30.0 feet below existing grade within the gray slightly weathered limestone primary. For cost estimation purposes, this equates to an average pier bearing elevation of approximately 856.0 feet (NGVD) for the Family Life Center, and an average pier bearing elevation of 854.0 feet (NGVD) for the Multipurpose Activity Center. Piers founded within the gray slightly weathered limestone primary at this depth shall be sized for an allowable end-bearing capacity of 25.0 ksf (net), based on a factor of safety that exceeds 3. Sizing the piers for this allowable bearing capacity will ensure that post-construction movements in the form of settlement will be negligible. The piers can be designed for both end bearing and skin friction if additional load-carrying capacity is required. An allowable side shear value of 750 psf (net) (per foot) shall be used for that portion of the pier shaft embedded within the limestone and marl/shale primary. For this design condition, the effective length ( $L_{eff}$ ) shall start 15 feet below existing grade (approximate contact depth of the limestone primary underlying the weathered marl/shale) or 5 feet below top of pier, whichever is deeper, and extend to within one shaft diameter of the final bearing depth. Individual piers can be extended if additional load-carrying capacity in side shear is required. Based on structural requirements, the load used to size the piers shall consist of full dead load plus that portion of the live load that acts more or less continuously, usually 50 percent. ***If the piers are designed for both end bearing and skin friction, the foundation notes need to reflect this condition.***

All pier shafts shall be a minimum of 18 inches in diameter to facilitate clean out and

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inspection of the pier holes during construction. A minimum of 1.0 percent reinforcing steel shall be placed in each pier shaft, based on the cross-sectional area of the pier to resist heave induced by the high plasticity overburden soils. A clear distance of at least three shaft diameters shall be maintained between individual piers. The larger size shall be used for this condition when shaft sizes differ. **A minimum 6-inch void shall be maintained beneath all grade beams, and the void area shall be protected with concrete retainer blocks.**

Concrete slump for piers shall be from 6 to 8 inches.

*The typical pier detail shall require the upper 5 feet of the pier shaft to be formed with a wax impregnated sonotube to eliminate a mushroom shaped pier top. The detail shall also show a wedge-shaped mound of Select Clay Backfill placed around the pier top that is 1 foot high and sloped at a 1V on 2H slope. This will prevent water from ponding directly around the top of the pier.* These requirements are illustrated on *Sheet B102*.

The contractor shall have temporary steel casing and pumps at the job site prior to construction of drilled piers. Groundwater should be anticipated during drilling operations; therefore, the above information should be provided in the contract documents as foundation notes. *It should be assumed that approximately 100 percent of all piers will have to be cased to at least 30 feet below existing grade. If the stated bearing depth (elevation) does not reveal the bearing material, the Contractor shall coordinate with the Contracting Officer's representative. Final pier depths shall be subject to approval in the field by the Contracting Officer's representative.*

Drilling equipment shall be of suitable type and of sufficient size to satisfactorily perform the required drilling for the soil conditions identified. To this end, all drill rigs shall have a 6-inch Kelly bar and be capable of producing minimum torque and crowd capacities of 50,000 lb-ft and 30,000 lb-ft, respectively.

*The Design-Build Contractor shall edit the drilled pier specification and add foundation notes to include the above criteria and requirements for drilled pier construction.*

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(b) Reinforced Concrete Ribbed Mat or Flat Mat Slab. If a shallow foundation system is used for the proposed Family Life Center buildings, the foundation system shall be either a reinforced concrete ribbed mat slab or flat mat slab foundation system. It should be noted that it is anticipated that a flat mat slab foundation system would be more easily adaptable to the somewhat irregular building footprint geometries presented elsewhere in the RFP. **The mat slabs shall be conventionally reinforced – POST-TENSIONED SLABS ARE NOT ALLOWED.** Based on the plasticity level of the near surface clayey and gravelly soils, the mat slabs shall be analyzed and designed for 1.0 inch of long-term differential movement. For this reason, interior ribs for ribbed mat slabs shall be spaced no further than 15 feet center-to-center, and diagonal stiffener ribs shall be placed at each corner of the mat slab. Design of the mat slabs shall meet the minimum requirements as presented in *CESWD-ED-TS/G Criteria Letter, dated 29 January 1988 – Design Criteria for Ribbed Mat Foundations*, *SWDED-G Criteria Letter, dated 16 April 1987 – Criteria for Developing Geotechnical Design Parameters for SWD Ribbed Mat Design Methodology*, and the recommendations and requirements provided herein.

Interior and exterior beams for ribbed mat slabs should bottom a minimum of 24 inches below outside finished grade. An allowable bearing capacity of 2.0 ksf (net) shall be used to size the beams. For this phase of design, it should be noted that (1) the structural load is supported solely on the beam and the beam intersections, (2) load transfer occurs over the effective beam width, and (3) the beam and soil remain in contact. Beam intersections should be widened at column locations to accommodate the above allowable bearing value for the anticipated load condition. The load used to size the beams shall consist of full dead load plus that portion of the live load that acts more or less continuously, usually 50 percent.

The ribbed mat slab foundations shall incorporate adequate stiffness such that the deformations do not exceed the structural tolerance of any elements in the foundation or superstructure. Analyses shall consider a vertical separation of the foundation slab and beams from the subgrade of 1.0 inch at the outside of all perimeter beams, with loss of support

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beneath the foundation over a horizontal distance of not less than 6.5 feet. This loss of support condition corresponds to the **center lift mode**. Additionally, **edge lift analyses** shall consider an edge moisture variation distance equal to 3.0 feet, and an edge lift heave of 1.0 inch should be used in the design of the ribbed mat slab. This edge lift heave corresponds to an applied structural pressure of 100 psf. For edge lift considerations, two additional combinations of pressure and swell are required. For an allowable bearing capacity of 2.0 ksf, an edge lift heave of 0.75-inch can be expected to occur. At an ultimate bearing capacity of 6.0 ksf, 0.50-inch of heave should be anticipated. It should be noted that these anticipated heave amounts are based on the removal of 3.0 feet of existing materials under building floor slabs and replacement with compacted nonexpansive fill, as required herein. Mat slab designs shall incorporate appropriate stiffness and isolation measures, as previously stated, in order to ensure the foundation will perform monolithically and minimize stress concentrations induced by irregular building geometries. These measures shall include additional stiffness at corners and isolation of slab units to limit deflections to tolerable limits not affecting the façade and interior wall/ceiling finishes. If additional soils investigations, testing, and analyses show that a more stringent design is required to successfully mitigate total and differential movements due to settlement and/or heave, the foundation shall be designed accordingly.

A modulus of subgrade reaction equal to 200 psi/inch shall be used when analyzing the ribbed mat slabs to determine in-service deformations. This value, however, shall be factored to account for width effects such that  $k_{\text{design}} = k_1 / (B_{\text{eff}})$ , where  $B_{\text{eff}}$  is the effective beam width in feet.

A flat mat shall have a uniform thickness of not less than 2.0 feet. An allowable bearing capacity of 2.0 ksf (net) shall be used to size the mat foundation. The mat should be tapered as required to ensure the perimeter of the slab extends to a constant elevation and is at least 24 inches below outside finish grade. Flat mat slabs also shall incorporate adequate stiffness such that the deformations do not exceed the structural tolerance of any element of the foundations or superstructures nor cosmetic cracking of interior and exterior finishes. Control

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joints/panels shall be incorporated within interior finishes and exterior facades to help control potential cracking due to slab movements. The load used to size the flat mat slab shall consist of full dead load plus that portion of the live load that acts more or less continuously, usually 50 percent.

If additional investigations and/or analyses by the Design-Build Contractor's geotechnical firm indicate greater movements or more stringent requirements of mat stiffness are warranted, the mat shall be designed accordingly.

The mat slabs will, by design, be supported on-grade. A polyethylene vapor barrier (10-mil minimum thickness) and a minimum 6-inch capillary water barrier should be placed beneath the mat slab.

(c) Small Support-type Structures. Covered pavilions and any other small ( $\leq 500$  GSF) support-type structures, if applicable, can be supported on a reinforced concrete slab-on-grade with turned-down edge beam foundation. The turned-down edge beam shall extend a minimum of 12 inches below outside finished grade, and shall be sized for a safe bearing pressure of 2,000 psf (net). Subgrade preparation shall be in accordance with the requirements specified below for ribbed and flat mat slabs.

(2) Ground-Level Floor Slab System. If a straight-shaft drilled pier foundation system is used, ground-level floor slabs shall be supported above a minimum 6-inch void or crawl space. The void area shall be protected with concrete retainer blocks. Stoops, porches, approaches, etc. shall also be structurally-supported to compensate for the active subgrade. If the design requires the incorporation of a crawl space beneath the building, the underfloor area shall be sloped to collection points and drained using sumps and pumps. Swales shall drain away from pier column locations such that ponded water never occurs adjacent to piers.

The mat slab systems, if used, will, by design, be supported on-grade.

(3) Subgrade Preparation and Fill Requirements. If a reinforced concrete straight-shaft drilled pier foundation system is used, subgrade preparation for portions of the building pad that will be in a fill section shall consist of removing the upper 12 inches of



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existing materials and replacing with a compacted select backfill. Any additional fill required to raise the subgrade to the final elevation(s) below the building floor slab system shall be select material as well. Select fill should be placed in controlled lifts not exceeding 8 inches in loose thickness and compacted to at least 90 percent of laboratory maximum density as determined in accordance with ASTM D 1557. For portions of the building pad that will be a cut section, subgrade preparation should consist of removing all existing materials to a depth that allows a minimum 6-inch void to be formed below the floor slab system. The upper 6 inches of existing subgrade exposed after cut and/or fill operations shall be scarified, moistened, and recompact to the same density required for select fill.

For ribbed mat and flat mat slab foundations, the upper 3.0 feet (minimum) of existing soils within the proposed building footprints shall be removed and replaced with compacted nonexpansive backfill, which should limit the magnitude of predicted movement to approximately 1 inch or less. Any additional fill required to achieve the final subgrade elevation below the floor slab system shall be nonexpansive material as well. The upper 6 inches of existing subgrade exposed after excavation operations, or cleared prior to fill placement shall be scarified, moistened, manipulated, and recompact to the same density required for nonexpansive fill materials. Nonexpansive fill shall be placed in controlled lifts not exceeding 8 inches in loose thickness and compacted to at least 95 percent of laboratory maximum density (in accordance with ASTM D 1557). A polyethylene vapor barrier (10-mil minimum thickness) and a minimum 6-inch capillary water barrier shall be provided beneath floor slabs supported on-grade.

Based on previous experience, if nonexpansive fill is placed outside the limits of the building footprint, the relatively higher permeability of the nonexpansive fill will allow moisture to infiltrate to the highly expansive soils adjacent to and beneath the foundation, potentially resulting in heave of the foundation. To limit moisture penetration to the area around and beneath the foundation, excavated areas beyond the limits of the building footprint shall be backfilled with select clay backfill materials. This select clay cap shall be a minimum

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of 2 feet in thickness and shall extend from the building perimeter to the limits of the excavation (completely capping/covering the compacted nonexpansive fill). Select clay backfill materials should be compacted to at least 92 percent of laboratory maximum density (with all other subgrade preparation and fill placement requirements being the same as those for nonexpansive fill).

(4) Material Testing Requirements. Testing shall be the responsibility of the contractor to ensure that the subgrade, fill, and backfill materials are properly compacted. To this end, the Design-Build Contractor shall comply with the minimum testing frequencies specified in the RFP.

(5) Below-Grade Structures (Including Retaining Walls) (If Applicable). The following information is provided for the design of all below-grade structures, if applicable. An at-rest lateral earth pressure coefficient ( $k_0$ ) of 0.7, an angle of internal friction ( $\phi$ ) of  $28^\circ$ , a cohesion value ( $c$ ) of 100 psf, and an allowable bearing capacity of 2,000 psf shall be used. The backfill material shall be assumed to have a moist unit weight of  $125 \text{ lb/ft}^3$  and all backfill shall be nonexpansive or select material, as specified herein. The Design-Build Contractor's analyses and designs for below grade structures (including retaining walls) shall also account for surcharge loadings (e.g., due to vehicular traffic) where applicable.

(6) Drainage Conditions. Proper site drainage is imperative to ensure satisfactory long-term foundation performance. Exterior grading adjacent to the buildings shall be sloped away from the structures a minimum of 5 percent for the first 10 feet. Runoff from the roofs shall be adequately discharged away from foundation edges. In no case should water be allowed to pond adjacent to or beneath the buildings, both during and after construction.

(7) Care of Water. Drainage of ground and surface water from the project site continually throughout the construction contract is essential. The contractor shall be required to protect the excavation and all constructed work throughout the life of the contract by means

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of ditches, berms, sumps with pumps, and any other means required to continually and effectively remove water from the site at all times. Ponding of water in the excavation or around the piers (if used) is unacceptable at any time. In addition, site excavations to include the crawl space excavation (if used), utility trenching, grading, and retention basins shall be constructed so as not to supply water directly or indirectly to the building or underlying active clayey soils and marl/shale. Such exposure of the underlying active clayey soils and marl/shale to surface runoff during construction could extend the active zone (via fractures) to much greater depths within the marl/shale. This would activate these highly expansive materials and result in expansion pressures on the foundation elements that could create distress on the structural system of the facility. ***These requirements shall be reflected in the specifications and in the structural notes.***

The designer shall grade the site to ensure positive drainage of all water away from the structure. Crawl spaces (if used) will be graded to collect water and carry it to sumps. The sumps will drain by gravity or be equipped with automatic pumps to direct the water to the storm drainage system. Sumps will be located at least 10 feet away from any pier in the crawlspace.

(8) Mechanical Connections. All exterior mechanical connections should be of the flexible type. Flexible connections shall be capable of resisting a minimum of 1 inch of both vertical and horizontal movement. All mechanical/structural connections between slabs on grade and structurally supported units or building perimeter entry/exit points must be designed and constructed to handle up to 1 inches of vertical movement. All condensate lines shall drain away from foundation edges. It is recommended that below-grade utility lines connecting to the buildings be aligned under the centerline of the respective building footprint. The use of exterior lines connecting to the buildings by numerous utility trenches is discouraged, as this would create high permeability pathways for moisture to gain access to, and activate, the expansive clay and marl/shale materials within the building footprint.

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(9) Backfill Adjacent to Exterior Grade Beam Excavation. Use select clay backfill adjacent to exterior grade beam excavation to minimize water penetration to expansive subsoils.

(10) Foundation Material Definitions.

(a) Satisfactory Materials. Satisfactory materials include materials classified in ASTM D 2487 as GW, GM, GC, GP, SW, SP, SM, SC, CL, and CH and shall be free of trash, debris, roots or other organic matter, or stones larger than 3 inches in any dimension.

(b) Unsatisfactory Materials. Unsatisfactory materials include materials classified in ASTM D 2487 as Pt, OH, OL, ML, MH and any other materials not defined as satisfactory.

(c) Nonexpansive Soils. Nonexpansive soils should meet the requirements of Texas Department of Transportation Standard Specification for Base Course, Item 247, Type A, Grade 1 or 2, with plasticity index of not less than 4 percent nor greater than 12 percent when tested in accordance with ASTM D 4318.

(d) Select Soils. Select soils are satisfactory material having a liquid limit of 35 percent or less and a plasticity index not less than 8 nor greater than 18 when tested in accordance with ASTM D 4318.

(e) Select Clay Backfill. Select clay backfill shall be a satisfactory material having a liquid limit of 35 percent or less, and a plasticity index of not less than 8 nor greater than 20 when tested in accordance with ASTM D 4318, and classifying as a CL in accordance with ASTM D 2487.

(f) Cohesionless and Cohesive Materials. Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

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(g) Capillary Water Barrier. Capillary Water Barrier shall consist of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel. The maximum particle size shall be 1.5 inches and no more than 2 percent by weight shall pass the 3/16-inch size (No. 4) sieve.

The Design-Build Contractor shall utilize and comply with above material definitions, subgrade preparation procedures, and material testing requirements.

b. Pavement Design Recommendations and Requirements. The minimum pavement sections presented below are based on criteria contained in *UFC 3-250-01FA*, *UFC 3-250-18FA*, and engineering judgment. The Design-Build Contractor is responsible for developing the final pavement designs. The Design-Build Contractor shall use the subsurface conditions and laboratory testing data provided in this report, as well as the supplemental subsurface investigations and testing required herein, and any supplemental information regarding traffic loading conditions and requirements (beyond that provided herein) to develop the final pavement designs. The Design-Build Contractor shall use the United Facilities Criteria (UFCs) cited herein, as well as Pavement-Transportation Computer Assisted Structural Engineering (PCASE) software (available at <https://transportation.wes.army.mil/triservice/pcase/> as a free download) to develop the final pavement designs. However, **it is required that the Design-Build Contractor's final pavement sections meet (or exceed) the minimum pavement sections specified herein.** As previously stated, at the time of this report, it is anticipated that either rigid or flexible pavement structures may be used for the fire/emergency medical vehicle access lanes, service drives, and POV parking area(s). Therefore, optional rigid and flexible minimum pavement sections are provided for these three pavement structures, while a minimum rigid pavement structure is provided for aprons in front of trash dumpster pads.

(1) Rigid Pavement. The following minimum pavement sections shall be used for fire/emergency medical vehicle access lanes (rigid pavement option), service drives (rigid pavement option), privately-owned vehicle (POV) parking area(s) (rigid pavement option), and for aprons for a minimum distance of 15 feet in front of trash dumpster pads. The rigid

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pavement designs consider a modulus of subgrade reaction equal to 100 pci for the raw subgrade when compacted to 90 percent of laboratory maximum density, and a concrete flexural strength of 650 pci at 28 days.

(a) Fire/Emergency Medical Vehicle Access Lanes and Service Drives (Rigid Pavement Option). The pavement section is based on Category IVA Traffic and a Class F Street (Design Index = 4).

7" Portland Cement Concrete (nonreinforced)

6" Aggregate Base Course compacted to at least 95 percent of maximum laboratory density (ASTM D 1557)

6" Raw Subgrade compacted to at least 90 percent of maximum laboratory density (ASTM D 1557)

(b) POV Parking Area(s) and POV Access Drive(s) (Rigid Pavement Option). The pavement section is based on Category II Traffic and a Class E Street (Design Index = 2).

6" Portland Cement Concrete (nonreinforced)

6" Aggregate Base Course compacted to at least 95 percent of maximum laboratory density (ASTM D 1557)

6" Raw Subgrade compacted to at least 90 percent of maximum laboratory density (ASTM D 1557)

(c) Aprons in Front of Trash Dumpster Pads. The pavement section is based on Category IVA Traffic and a Class F Street (Design Index = 4).

6" Portland Cement Concrete reinforced with No. 4 bars spaced 16 inches o.c.e.w.

6" Aggregate Base Course compacted to at least 95 percent of maximum laboratory density (ASTM D 1557)

6" Raw Subgrade compacted to at least 90 percent of maximum laboratory density (ASTM D 1557)

Reinforcement for odd-shaped slabs, joint design, joint spacing, and other details shall

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be in accordance with UFC 3-250-01FA, where applicable. The reinforcement bars shall be placed a minimum of 1.5 inches clear distance from the surface of the pavement.

(2) Flexible Pavement. The following minimum pavement sections shall be used for fire/emergency medical vehicle access lanes (flexible pavement option), service drives (flexible pavement option), and privately-owned vehicle (POV) parking areas (flexible pavement option). The flexible pavement designs consider a CBR value of 4 percent for the raw subgrade when compacted to 90 percent of laboratory maximum density.

(a) Fire/Emergency Medical Vehicle Access Lanes and Service Drives (Flexible Pavement Option). The pavement section is based on Category IVA Traffic and a Class F Street (Design Index = 4).

2" Hot-Mix Surface Course

6" Aggregate-Base Course compacted to at least 100 percent of maximum laboratory density (ASTM D 1557)

6" Subbase Course compacted to at least 95 percent of maximum laboratory density (ASTM D 1557)

6" Subbase Course compacted to at least 95 percent of maximum laboratory density (ASTM D 1557)

6" Raw Subgrade compacted to at least 90 percent of maximum laboratory density (ASTM D 1557)

(b) POV Parking Area(s) and POV Access Drives (Flexible Pavement Option). The pavement section is based on Category II Traffic and a Class E Street (Design Index = 2).

1.5" Hot-Mix Surface Course

7" Aggregate-Base Course compacted to at least 100 percent of maximum laboratory density (ASTM D 1557)

6" Subbase Course compacted to at least 95 percent of maximum laboratory density (ASTM D 1557)

6" Raw Subgrade compacted to at least 90 percent of maximum laboratory density (ASTM D 1557)

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The following notes should be incorporated as part of the pavement details shown on the contract drawings.

***“1. The moisture content shall be at least 1 percent above optimum during compaction of the raw subgrade.***

***2. The compacted subbase course in all of the paving sections can be replaced with aggregate base course using the same thickness and compaction requirements.”***

(3) Pavement Material Definitions.

(a) Hot-Mix Surface Course (50 Blow Mix). Aggregates and asphaltic materials shall conform to the requirements of the Texas Department of Transportation, Standard Specifications for Construction of Highways, Streets and Bridges, (TXDOT, Std Spec), Items 300 and 340. The paving mixture shall conform to the requirements for Type “D” (Fine-Graded surface course) grading. Asphaltic material for the paving mixture should be asphaltic cement, viscosity grade AC-20, or performance grade PG64-22. The specifications shall incorporate the above requirements for Hot-Mix Surface Course.

(b) Prime and Tack Coats. Asphaltic material for the prime coat shall be cut-back asphalt, grade MC-30, conforming to the requirements of TXDOT, Std Spec, Item 300, Asphalts, Oils, Emulsions. Prime coat shall be applied to the surface of the aggregate base coarse. Asphaltic material for the tack coat shall be cut-back asphalt, grade RC-250, or emulsified asphalt, grade SS-1, conforming to the requirements of TXDOT, Std Spec, Item 300, Asphalts, Oils, Emulsions. Tack coat shall be applied to all surfaces that contact new asphalt pavement. The specifications shall incorporate the above requirements for Prime and Tack Coats.

(c) Aggregate Base Course. Aggregates shall conform to the requirements presented herein. The gradation should conform to the requirements of TXDOT, Std Spec, Item 247, for Type “A”, Grade 1 Material with a plasticity index not greater than 10. Aggregates shall not show more than 50 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. The amount of flat and elongated particles



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shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregates shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve.

(d) Subbase Course. The material shall meet the requirements specified herein and shall have a CBR value of 20 percent. Aggregates shall consist of crushed stone, gravel, sand, or other sound, durable, approved materials processed and blended or naturally combined. Aggregates shall be durable and sound, free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material. Aggregates shall be reasonably uniform in density and quality. Aggregates shall have a maximum size of 2 inches and shall be within the limits specified as follows:

Maximum Allowable Percentage by Weight  
Passing Square-Mesh Sieve

<u>Sieve Designation</u>	<u>No. 1</u>
No. 10	--
No. 200	15

The portion of any blended component and of the completed course passing the No. 40 sieve shall be either nonplastic or shall have a liquid limit not greater than 25 and a plasticity index not greater than 5. Or, at the contractor's option, the contractor may use material conforming to Texas Department of Transportation Standard Specification, Item 247, Type A, Grade 1.

(e) Raw Subgrade. Material should conform to the requirements of Satisfactory Materials, as specified herein.

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(f) Portland Cement Concrete. The maximum nominal size coarse aggregate shall be 1.5 inches, and the mixture shall be designed to attain a flexural strength of 650 psi at 28 days, as determined by tests made in accordance with *ASTM C 78* of beams fabricated and cured in accordance with *ASTM C 192/C 192M*. Cementitious admixtures shall be limited to Class F fly ash; Class C fly ash shall not be used.

(4) Vehicular Pavement Material Testing Requirements. Testing shall be the responsibility of the contractor to ensure that the subgrade, aggregate base course, subbase course, hot-mix surface course, and Portland cement concrete are properly constructed. To this end, the following testing requirements shall be included in the contract specifications as a minimum:

- In-place density testing of the subgrade, aggregate base course, and subbase course shall be performed, at a minimum, every 600 square yards per lift in accordance with ASTM D 1556 and ASTM D 2922. ASTM D 1556 shall be used as a check at least once per lift for each 3,000 square yards of completed subgrade, aggregate base course, and subbase course.
- Before starting work, at least one sample of aggregate base course, and subbase course material shall be tested in accordance with ASTM C 136. After the initial test, a minimum of one sieve analysis (ASTM C 136 and ASTM D 422) shall be performed for each 1,000 tons of aggregate base course, and subbase course placed, with a minimum of one analysis performed for each day's run until the course is completed. One liquid limit and plasticity index shall be performed for each sieve analysis per ASTM D 4318
- Wear tests shall be performed in accordance with ASTM C 131. A minimum of one test per aggregate base course material source shall be run.
- Thickness of the aggregate base course, and subbase course shall be measured for each 600 square yards of material placed. Compacted thickness of the aggregate base, and subbase courses shall be as presented in this report and the completed section shall be within 3/8-inch of the thickness presented.
- Hot Bin gradations for the asphalt wearing course shall be tested in accordance with ASTM C 136 and ASTM C 117. A minimum of one test shall be conducted. Marshall specimens shall be taken in accordance with methods described in AI MS-2. At least two sets of specimens shall be taken. Asphalt extractions shall be performed in accordance with ASTM D 2172, Method A or B. At least one asphalt extraction shall be conducted. Field density tests shall be conducted in accordance with ASTM D 2950. One test shall be conducted for each 300 square yards of pavement placed. The mat density shall be 97.5 to 100.5 percent and the joint density shall be 95.5 to 100.5 percent of the density obtained from laboratory-compacted specimens. Thickness measurements shall

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be taken at a minimum of one measurement for each 1,000 square yards of pavement placed.

- The Job Mix Formula for the bituminous mixture shall be furnished to the Contraction Officer for approval. The formula will indicate the percentage of each stockpile and mineral filler, the percentage of each size aggregate, the percentage of bitumen, and the temperature of the completed mixture when discharged from the mixer. The Contractor shall file with the Contracting Officer certified delivery tickets for all aggregates and bituminous materials actually used in construction. The finished mixture shall be designed using procedures contained in AI MS-2 and the criteria shown below.

<u>Test Property</u>	<u>50 Blows</u>
Stability (minimum), lbs	500
Flow (maximum), 1/100-inch	8-18
Air Voids, percent	3% to 5%
Percent Voids in mineral aggregate	14
TSR, minimum percent	75

- The contractor shall be responsible for the development of the mixture proportion study for cementitious materials and chemical admixtures. The concrete mix design shall include a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of concrete at least 60 days prior to commencing concrete operations. Trial design batches, mixture proportioning studies, and testing requirements shall be the responsibility of the Contractor. Strength requirements shall be based on flexural strength. Trial mixtures having proportions, slumps, and air content suitable for the work shall be based on methodology described in ACI 211.1, modified as necessary to accommodate flexural strength. The maximum water-cementitious material ratio is 0.45. Coarse and fine aggregates shall have a satisfactory service record of at least 5 years successful service in three paving projects, or if a new source is used, shall meet the requirements when tested for resistance to freezing and thawing. Coarse and fine aggregates not having a satisfactory demonstrable service record shall have a durability factor of 50 when subjected to freezing and thawing in concrete in accordance with COE CRD-C 114 (Test Method for Soundness of Aggregates by Freezing and Thawing of Concrete Specimens).
- Smoothness measurements shall be taken in successive positions parallel to the pavement (flexible and rigid) centerline with a 12-foot straightedge. Measurements shall be taken perpendicular to the pavement (flexible and rigid) centerline at 15-foot intervals. Surface smoothness shall not exceed 3/8-inch.

c. **Requirements for the Design-Build Contractor's Foundation and Pavement**

**Design Analysis.** The successful proposer shall provide a Foundation and Pavement Design Analysis after contract award. *The geotechnical firm responsible for the geotechnical design*

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*shall have demonstrated successful performance in design of at least five (5) projects of similar type and scope in expansive soil environments in Texas.* The Foundation and Pavement Design Analysis (Report) shall include a description of the project, including a discussion of any unusual features of the project, a discussion for each structure that requires a foundation system, and a discussion of each pavement type. All calculations in support of bearing, settlement, heave, and structural deflections shall be included in or attached to the report.

(1) **Foundation System.** *A foundation system consisting of either reinforced concrete straight-shaft drilled piers, or a reinforced concrete ribbed mat slab or a reinforced concrete flat mat slab shall be used for the Family Life Center and Multipurpose Activity Center. The Design-Build Contractor shall design the straight-shaft drilled pier, ribbed mat, or flat mat foundation systems in accordance with the requirements, recommendations, and design parameters provided in this report.*

(2) **Floor Slab System, Subgrade Preparation and Fill Requirements.** *The Design-Build Contractor shall comply with the floor slab system, subgrade preparation, and fill requirements specified in this report. Excavation/removal of existing soil, compaction requirements for the raw subgrade, fill, and backfill materials, and foundation and pavement material definitions shall be as specified herein. Compaction shall be in accordance with the modified Proctor method (ASTM D 1557).*

(3) **Pavement Sections.** The Design-Build Contractor shall provide separate subparagraphs for each rigid and flexible pavement structure included in the project, *using the pavement sections provided in this report as minimum sections.* The Design-Build Contractor shall use the UFCs cited herein and PCASE pavement design software to develop the final pavement designs, and shall present PCASE design output data tables in their report documentation for review by the Government. Each pavement design shall include as a minimum the following items: traffic types, road classifications and design indexes; subgrade strength values (CBR and modulus of subgrade reaction values for the specified compactive

**FORT HOOD, TEXAS  
FAMILY LIFE CENTER**

effort); pavement material thicknesses and compaction requirements; and concrete flexural strength for designated time frame.

(4) Exhibits to be Included in the Design-Build Contractor's Foundation and Pavement Design Analysis. The following exhibits shall be included in the Design-Build contractor's Foundation and Pavement Design Analysis. The Design-Build contractor may use the information provided in this report to partially satisfy these requirements, but shall supplement the information provided herein with additional subsurface drilling and testing, as described in the first paragraph of Section 5 of this report. Required exhibits to be included with the Design-Build contractor's Foundation and Pavement Design Analysis include:

- Site Plan with Boring Locations and Legend;
- Boring Logs;
- Plasticity Chart;
- Standard Penetration Tests versus Depth of Boring (if applicable);
- Moisture Content versus Depth (Chart);
- Moisture Content-Liquid Limit-Plastic Limit versus Depth (Chart);
- Strength Tests Results versus Depth (Chart);
- Tabulation of Laboratory Test Results (to include Boring Number, Sample Number, Depth, Laboratory Classification, Visual Descriptions, Grain Size Analysis (%Gravel, %Sand, %Fines), LL, PL, PI, MC, Unit Weight, and Strength Test Data;
- Consolidation-Expansion Tests/Swell Pressure Tests (if applicable).

**FORT HOOD, TEXAS  
FAMILY LIFE CENTER**

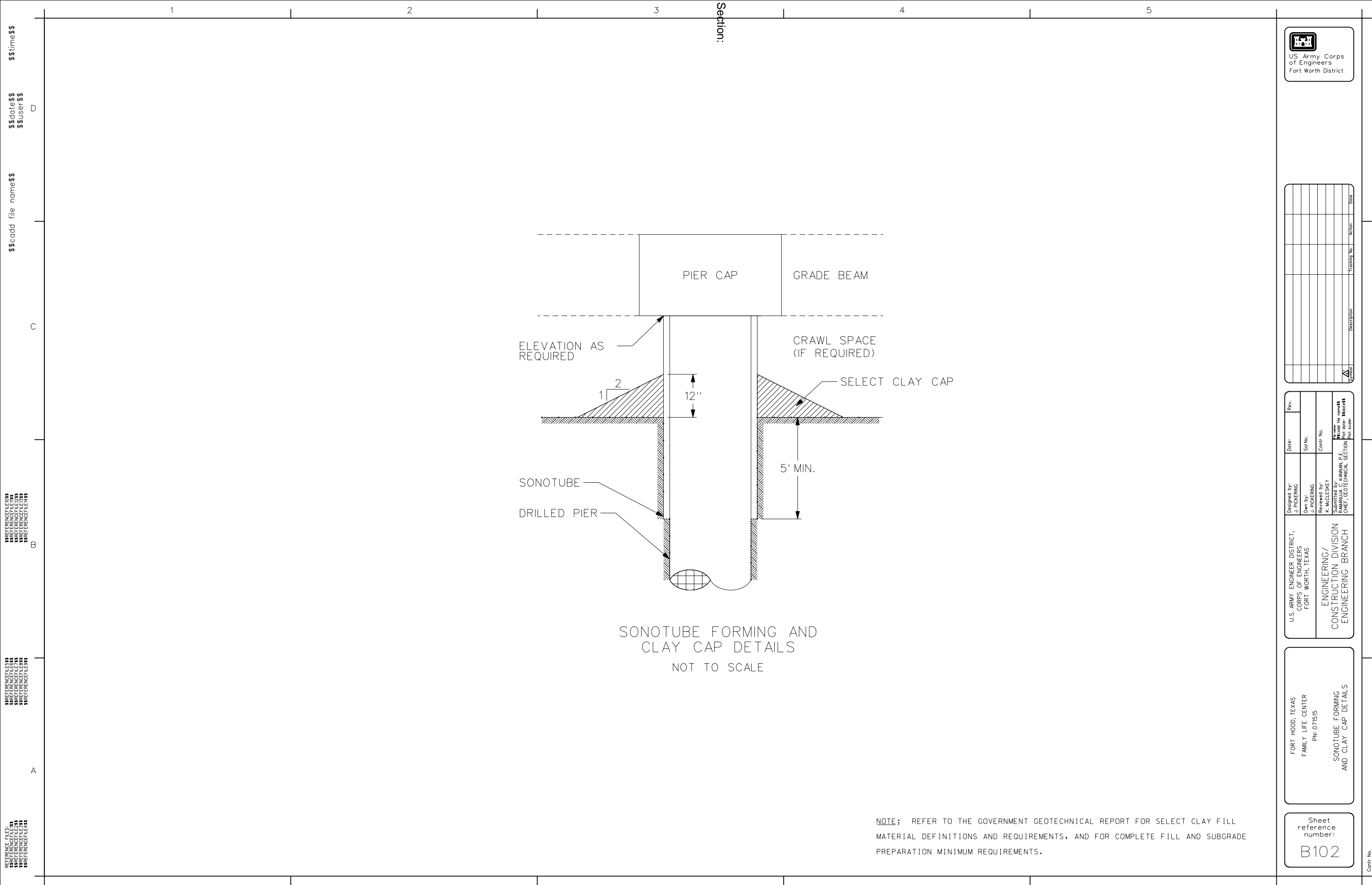
**References:**

- TEAM Consultants, Incorporated Report No. 092021 (Chapel and Religious Education Facility)
- TEAM Consultants, Incorporated Report No. 092025 (Child Development Center (0-5 Years) – Tank Battalion Avenue)
- UFC 3-220-03FA – Soils and Geology Procedures for Foundation Design of Buildings and Other Structures (Except Hydraulic Structures)
- UFC 3-220-07 – Foundations in Expansive Soils
- CESWD-ED-TS/G Criteria Letter, dated 29 January 1988 – Design Criteria for Ribbed Mat Foundations
- SWDED-G Criteria Letter, dated 16 April 1987 – Criteria for Developing Geotechnical Design Parameters for SWD Ribbed Mat Design Methodology
- UFC 3-250-01FA – Pavement Design for Roads, Streets, Walks, and Open Storage Areas
- UFC 3-250-18FA – General Provisions and Geometric Design For Roads, Streets, Walks, and Open Storage Areas
- Texas Department of Transportation - Standard Specifications For Construction of Highways, Streets and Bridges

**FORT WORTH DISTRICT  
MAY 2010**

**APPENDIX A**

**BORING LOCATIONS & LOGS OF BORINGS**







1

2

3

4

5

Section:

Hole No. 8A4C-CHAPEL-1

Hole No. 8A4C-CHAPEL-2

Hole No. 8A4C-CHAPEL-3

DRILLING LOG

DIVISION

INSTALLATION

SHEET

1

OF 1 SHEETS

1. PROJECT

2. LOCATION

3. DRILLING AGENCY

4. HOLE NO.

5. NAME OF DRILLER

6. DIRECTION OF HOLE

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE

10. SIZE AND TYPE OF BIT

11. DATUM FOR ELEVATION SHOWN

12. MANUFACTURER'S DESIGNATION OF DRILL

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER

16. DATE HOLE

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING

19. SIGNATURE OF INSPECTOR

CLASSIFICATION OF MATERIALS

LEGEND

DEPTH

MOISTURE CONTENT

BOX OR SAMPLE NO.

JAR SAMPLES

CORE SAMPLES

REMARKS

CHAPEL/RELIGIOUS EDUCATION FAC.

FORT HOOD, TEXAS

GEDCO DRILLING & CORING, INC.

8A4C-CHAPEL-1

EDDY GARCIA

☒ VERTICAL ☐ INCLINED

12.3'

32.7'

45.0'

SEE REMARKS

30 JAN 09

30 JAN 09

98 %

EDWARD GILYARD

CHAPEL/RELIGIOUS EDUCATION FAC.

FORT HOOD, TEXAS

GEDCO DRILLING & CORING, INC.

8A4C-CHAPEL-2

EDDY GARCIA

☒ VERTICAL ☐ INCLINED

11.7'

33.3'

45.0'

SEE REMARKS

30 JAN 09

30 JAN 09

95 %

TONYA SONSTENG

CHAPEL/RELIGIOUS EDUCATION FAC.

FORT HOOD, TEXAS

GEDCO DRILLING & CORING, INC.

8A4C-CHAPEL-3

EDDY GARCIA

☒ VERTICAL ☐ INCLINED

11.4'

33.6'

45.0'

SEE REMARKS

29 JAN 09

29 JAN 09

97 %

TONYA SONSTENG

U.S. Army Corps of Engineers

Fort Worth District

ENGINEERING/CONSTRUCTION DIVISION

DESIGN BRANCH

LOGS OF BORINGS - 1 OF 5

Sheet reference number: B201

NOTES:

1. USE THIS SHEET FOR BORING LOGS ONLY.

2. MOISTURE CONTENT, WHERE SHOWN, IS EXPRESSED AS PERCENT DRY WEIGHT AT TIME OF LABORATORY CLASSIFICATION.

3. LEGEND SHOWS OVERBURDEN MATERIALS CLASSIFIED ACCORDING TO ASTM D 2487 AND ASTM D 2488.

4. DESCRIPTION OF OVERBURDEN MATERIALS CHANGED TO CORRESPOND WITH LABORATORY CLASSIFICATION AS NECESSARY.

Section:

Hole No. 8A4C-CHAPEL-4

DRILLING LOG		DIVISION SOUTHWESTERN		INSTALLATION FORT WORTH DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT CHAPEL/RELIGIOUS EDUCATION FAC.				10. SIZE AND TYPE OF BIT * SEE REMARKS			
2. LOCATION(Coordinates or Station) FORT HOOD, TEXAS				11. DATUM FOR ELEVATION SHOWN(TBM or MSL) N/A			
3. DRILLING AGENCY GEDCO DRILLING & CORING, INC.				12. MANUFACTURER'S DESIGNATION OF DRILL GARDNER-DENVER 1000			
4. HOLE NO(s) shown on drawing title and file number)		8A4C-CHAPEL-4		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED 4	UNDISTURBED 0
5. NAME OF DRILLER EDDY GARCIA				14. TOTAL NUMBER CORE BOXES 6			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER ** SEE REMARKS			
7. THICKNESS OF OVERBURDEN 11.2'				16. DATE HOLE STARTED 29 JAN 09 COMPLETED 29 JAN 09			
8. DEPTH DRILLED INTO ROCK 33.8'				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 45.0'				18. TOTAL CORE RECOVERY FOR BORING 98 %			
				19. SIGNATURE OF INSPECTOR TONYA SONSTENG			
% MOISTURE CONTENT a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVER- Y e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
12.0			0.0' TO 1.9'		J-1	JAR SAMPLES:	
			CLAY-BROWN TO LIGHT BROWN DRY, HARD, SANDY FAT CLAY (CH).		J-2	J-1: 0.0' TO 0.8' J-2: 2.0' TO 3.5' J-3: 5.0' TO 7.5' J-4: 11.5' TO 13.0'	
6.5			1.9' TO 11.2'				
17.3			CLAY-LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY TO MOIST, HARD, LEAN CLAY (CL) WITH WEATHERED LIMESTONE SEAMS, SAND, AND CALCAREOUS MATERIAL.		J-3		
	10		11.2' TO 18.3'		J-4	CORE SAMPLES: C-1: 16.5' TO 17.0' C-2: 23.6' TO 24.3' C-3: 26.5' TO 27.4' C-4: 30.7' TO 31.5' C-5: 39.2' TO 40.0' C-6: 40.4' TO 41.2'	
8.2			MARL/SHALE-YELLOWISH BROWN, DRY TO SLIGHTLY MOIST, MODERATELY HARD, WEATHERED MARLY LIMESTONE WITH CLAY/SHALE SEAMS, AND SHELL FOSSILS.		C-1		
6.4			18.3' TO 45.0'				
20			LIMESTONE				
			18.3' TO 26.1'- YELLOWISH BROWN AND GRAY, HARD, WEATHERED, FRACTURED AND INTERBEDDED WITH CLAY/SHALE SEAMS AND SHELL FOSSILS.		C-2		
11.5			26.1' TO 45.0'- LIGHT GRAY TO GRAY, HARD TO VERY HARD, SLIGHTLY WEATHERED, WITH SOME FRACTURES AND SHELL FOSSILS.		C-3		
10.6					C-4		
30					C-5		
7.9					C-6		
10.6							
9.0							
40						*0.0' TO 15.0'- 6" ROLLER CONE BIT 15.0' TO 45.0'-4" I.D. CARBOLOY BIT CORE BARREL	
			BORING TERMINATED AT 45.0'			** NO GROUNDWATER MEASURED UPON COMPLETION. 24-HR GROUNDWATER AT 39.0' AND BORING OPEN TO 45'.	
			BORING LOCATION: X-618712 Y-3445175 LAT. N31°8'4.2" LONG. W97°45'17.3"				
50							

Hole No. 8A4C-CHAPEL-5

DRILLING LOG		DIVISION SOUTHWESTERN		INSTALLATION FORT WORTH DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT CHAPEL/RELIGIOUS EDUCATION FAC.				10. SIZE AND TYPE OF BIT * SEE REMARKS			
2. LOCATION (Coordinates or Station) FORT HOOD, TEXAS				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) N/A			
3. DRILLING AGENCY GEDCO DRILLING & CORING, INC.				12. MANUFACTURER'S DESIGNATION OF DRILL GARDNER-DENVER 1000			
4. HOLE NO(s) shown on drawing title and file number)		8A4C-CHAPEL-5		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED 4 UNDISTURBED 1	
5. NAME OF DRILLER EDDY GARCIA				14. TOTAL NUMBER CORE BOXES 6			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER ** SEE REMARKS			
7. THICKNESS OF OVERBURDEN 8.7'				16. DATE HOLE		STARTED 29 JAN 09 COMPLETED 29 JAN 09	
8. DEPTH DRILLED INTO ROCK 36.3'				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 45.0'				18. TOTAL CORE RECOVERY FOR BORING 98 %			
				19. SIGNATURE OF INSPECTOR TONYA SONSTENG			
% MOISTURE CONTENT a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
		VISUAL	0.0' TO 3.2'		ST-1	SHELBY TUBE SAMPLE: ST-1: 0.0' TO 2.0'	
17.5			CLAY-BROWN TO LIGHT BROWN. DRY, HARD, FAT CLAY (CH).		J-1		
		VISUAL	3.2' TO 8.7'			JAR SAMPLES: J-1: 2.0' TO 3.0' J-2: 5.0' TO 6.0' J-3: 9.0' TO 10.0' J-4: 11.0' TO 12.0'	
14.6					J-2		
		VISUAL	CLAY-LIGHT YELLOWISH BROWN TO YELLOWISH BROWN. DRY TO MOIST, HARD, LEAN CLAY (CL) WITH SAND, WEATHERED LIMESTONE SEAMS, AND CALCAREOUS MATERIAL.				
7.9	10				J-3	CORE SAMPLES: C-1: 18.6' TO 19.4' C-2: 21.9' TO 22.7' C-3: 27.9' TO 28.5' C-4: 33.7' TO 34.5' C-5: 37.8' TO 38.4' C-6: 43.0' TO 43.8'	
10.6			8.7' TO 14.8'		J-4		
			MARL/SHALE-YELLOWISH BROWN, DRY TO SLIGHTLY MOIST, MODERATELY HARD, WEATHERED MARLY LIMESTONE WITH CLAY/SHALE SEAMS, AND SHELL FOSSILS.				
11.9	20		14.8' TO 45.0'		C-1		
			LIMESTONE				
10.5			14.8' TO 24.2'- LIGHT YELLOWISH BROWN AND GRAY HARD, WEATHERED, FRACTURED AND INTERBEDDED WITH CLAY/SHALE SEAMS AND SHELL FOSSILS.		C-2		
9.6	30		24.2' TO 45.0'- LIGHT GRAY TO GRAY, HARD TO VERY HARD, SLIGHTLY WEATHERED, WITH SOME FRACTURES AND SHELL FOSSILS.		C-3		
11.7					C-4		
9.6	40				C-5		
9.6					C-6	*0.0' TO 15.0'- 6" ROLLER CONE BIT 15.0' TO 45.0'-4" I.D. CARBOLOY BIT CORE BARREL	
			BORING TERMINATED AT 45.0'			** NO GROUNDWATER MEASURED UPON COMPLETION. 24-HR GROUNDWATER AT 11.0' AND BORING OPEN TO 45'.	
			BORING LOCATION: X-618740 Y-3445186 LAT. N31°8'4.5" LONG. W97°45'16.2"				
	50						

[illegible]

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS	Designed by: K. MCLESKEY	Date:	Rev.
	Dwn by: K. MCLESKEY	Sol No.	
	Reviewed by: L. PERRIN	Contr No.	
ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH	Submitted by: LESLIE L. PERRIN, P.E. CHIEF, GEOTECHNICAL SECTION	For use in connection with Plans and Specifications Project No. <b>65-0445</b> Project Name:	

FORT HOOD, TEXAS  
CHAPEL COMPLEX  
PN: 025033

Sheet  
reference  
number:  
B202

NOTES:	
1. USE THIS SHEET FOR BORING LOGS ONLY.	3. LEGEND SHOWS OVERBURDEN MATERIALS CLASSIFIED ACCORDING TO ASTM D 2487 AND ASTM D 2488.
2. MOISTURE CONTENT, WHERE SHOWN, IS EXPRESSED AS PERCENT DRY WEIGHT AT TIME OF LABORATORY CLASSIFICATION.	4. DESCRIPTION OF OVERBURDEN MATERIALS CHANGED TO CORRESPOND WITH LABORATORY CLASSIFICATION AS NECESSARY.

1

2

3

4

5

Section:

Hole No. 10A-CHAPEL -6

Hole No. 10A-CHAPEL -7

Hole No. 10A-CHAPEL -8

DRILLING LOG

DIVISION

INSTALLATION

SHEET

SOUTHWESTERN

FORT WORTH DISTRICT

1

1

CHAPEL/RELIGIOUS EDUCATION FAC.

CHAPEL/RELIGIOUS EDUCATION FAC.

CHAPEL/RELIGIOUS EDUCATION FAC.

CHAPEL/RELIGIOUS EDUCATION FAC.

1. PROJECT

2. LOCATION

3. DRILLING AGENCY

4. HOLE NO.

5. NAME OF DRILLER

6. DIRECTION OF HOLE

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE

10. SIZE AND TYPE OF BIT

11. DATUM FOR ELEVATION SHOWN

12. MANUFACTURER'S DESIGNATION OF DRILL

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER

16. DATE HOLE

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING

19. SIGNATURE OF INSPECTOR

SEE REMARKS

N/A

GARDNER-DENVER 1000

3

0

SEE REMARKS

30 JAN 09

30 JAN 09

N/A %

EDWARD GILYARD

% MOISTURE CONTENT

DEPTH

LEGEND

CLASSIFICATION OF MATERIALS

% CORE RECOVERY

BOX OR SAMPLE NO.

REMARKS

0.0' TO 6.2'

CLAY-BROWN TO LIGHT BROWN, DRY, HARD, FAT CLAY (CH).

6.2' TO 7.9'

CLAY-LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY TO MOIST, HARD, FAT CLAY (CH) WITH WEATHERED LIMESTONE SEAMS.

7.9' TO 10.0'

MARL/SHALE-YELLOWISH BROWN, DRY TO SLIGHTLY MOIST, MODERATELY HARD, WEATHERED MARLY LIMESTONE WITH CLAY/SHALE SEAMS, SAND, AND CALCAREOUS MATERIAL.

BORING TERMINATED AT 10.0'

BORING LOCATION:  
X-618812 Y-3445149  
LAT. N31°8'3.2"  
LONG. W97°45'13.5"

J-1

J-2

J-3

\*0.0' TO 10.0' - 5" ROLLER CONE BIT.

\*\* NO GROUNDWATER MEASURED UPON COMPLETION.

ENG FORM 1836

PREVIOUS EDITIONS ARE OBSOLETE.

MAR 71

PROJECT

CHAPEL/RELIG. ED. FAC.

HOLE NO.

10A-CHAPEL-6

DRILLING LOG

DIVISION

INSTALLATION

SHEET

SOUTHWESTERN

FORT WORTH DISTRICT

1

1

CHAPEL/RELIGIOUS EDUCATION FAC.

CHAPEL/RELIGIOUS EDUCATION FAC.

CHAPEL/RELIGIOUS EDUCATION FAC.

CHAPEL/RELIGIOUS EDUCATION FAC.

1. PROJECT

2. LOCATION

3. DRILLING AGENCY

4. HOLE NO.

5. NAME OF DRILLER

6. DIRECTION OF HOLE

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE

10. SIZE AND TYPE OF BIT

11. DATUM FOR ELEVATION SHOWN

12. MANUFACTURER'S DESIGNATION OF DRILL

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER

16. DATE HOLE

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING

19. SIGNATURE OF INSPECTOR

SEE REMARKS

N/A

GARDNER-DENVER 1000

2

0

SEE REMARKS

30 JAN 09

30 JAN 09

N/A %

EDWARD GILYARD

% MOISTURE CONTENT

DEPTH

LEGEND

CLASSIFICATION OF MATERIALS

% CORE RECOVERY

BOX OR SAMPLE NO.

REMARKS

0.0' TO 4.8'

CLAY-BROWN TO LIGHT BROWN, DRY, HARD, FAT CLAY (CH) WITH SAND.

4.8' TO 10.0'

CLAY-LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY TO MOIST, HARD, LEAN CLAY (CL) WITH WEATHERED LIMESTONE SEAMS AND CALCAREOUS MATERIAL.

BORING TERMINATED AT 10.0'

BORING LOCATION:  
X-618629 Y-3445196  
LAT. N31°8'4.9"  
LONG. W97°45'20.4"

J-1

J-2

\*0.0' TO 10.0' - 5" ROLLER CONE BIT.

\*\* NO GROUNDWATER MEASURED UPON COMPLETION.

ENG FORM 1836

PREVIOUS EDITIONS ARE OBSOLETE.

MAR 71

PROJECT

CHAPEL/RELIG. ED. FAC.

HOLE NO.

10A-CHAPEL-7

DRILLING LOG

DIVISION

INSTALLATION

SHEET

SOUTHWESTERN

FORT WORTH DISTRICT

1

1

CHAPEL/RELIGIOUS EDUCATION FAC.

CHAPEL/RELIGIOUS EDUCATION FAC.

CHAPEL/RELIGIOUS EDUCATION FAC.

CHAPEL/RELIGIOUS EDUCATION FAC.

1. PROJECT

2. LOCATION

3. DRILLING AGENCY

4. HOLE NO.

5. NAME OF DRILLER

6. DIRECTION OF HOLE

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE

10. SIZE AND TYPE OF BIT

11. DATUM FOR ELEVATION SHOWN

12. MANUFACTURER'S DESIGNATION OF DRILL

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER

16. DATE HOLE

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING

19. SIGNATURE OF INSPECTOR

SEE REMARKS

N/A

GARDNER-DENVER 1000

3

0

SEE REMARKS

30 JAN 09

30 JAN 09

N/A %

EDWARD GILYARD

% MOISTURE CONTENT

DEPTH

LEGEND

CLASSIFICATION OF MATERIALS

% CORE RECOVERY

BOX OR SAMPLE NO.

REMARKS

0.0' TO 3.8'

CLAY-BROWN TO LIGHT BROWN, DRY, HARD, SANDY LEAN CLAY (CL) WITH TRACE LIMESTONE GRAVEL.

3.8' TO 7.3'

CLAY-LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY TO MOIST, HARD, LEAN CLAY (CL) WITH WEATHERED LIMESTONE SEAMS.

7.3' TO 10.0'

MARL/SHALE-YELLOWISH BROWN, DRY TO SLIGHTLY MOIST, MODERATELY HARD, WEATHERED MARLY LIMESTONE WITH CLAY/SHALE SEAMS, SAND AND CALCAREOUS MATERIAL.

BORING TERMINATED AT 10.0'

BORING LOCATION:  
X-618547 Y-3445198  
LAT. N31°8'5.0"  
LONG. W97°45'23.5"

J-1

J-2

J-3

\*0.0' TO 10.0' - 5" ROLLER CONE BIT.

\*\* NO GROUNDWATER MEASURED UPON COMPLETION.

ENG FORM 1836

PREVIOUS EDITIONS ARE OBSOLETE.

MAR 71

PROJECT

CHAPEL/RELIG. ED. FAC.

HOLE NO.

10A-CHAPEL-8

US Army Corps of Engineers  
Fort Worth District

U.S. ARMY ENGINEER DISTRICT,  
CORPS OF ENGINEERS  
FORT WORTH, TEXAS

ENGINEERING/  
CONSTRUCTION DIVISION  
DESIGN BRANCH

FORT HOOD, TEXAS  
CHAPEL COMPLEX  
PN: 025033

LOGS OF BORINGS - 3 OF 5

Sheet  
reference  
number:  
B203

DESIGNED BY:  
K. MCLESKEY

DRAWN BY:  
K. MCLESKEY

REVIEWED BY:  
L. PERRIN

SUBMITTED BY:  
LESLIE L. PERRIN, P.E.  
CHIEF, GEOTECHNICAL SECTION

DATE:  
12/1/08

SHEET NO.:  
3

CONTRACT NO.:  
025033

PROJECT NO.:  
025033

SECTION:  
DESIGN

DATE:  
12/1/08

POST SCALE:

Rev.

Date

Soil No.

Contr. No.

As shown file name

Plot date

Post scale

DESIGN FILE: \$cadd file name\$

Contr. No.

NOTES:  
1. USE THIS SHEET FOR BORING LOGS ONLY.  
2. MOISTURE CONTENT, WHERE SHOWN, IS EXPRESSED AS PERCENT DRY WEIGHT AT TIME OF LABORATORY CLASSIFICATION.  
3. LEGEND SHOWS OVERBURDEN MATERIALS CLASSIFIED ACCORDING TO ASTM D 2487 AND ASTM D 2488.  
4. DESCRIPTION OF OVERBURDEN MATERIALS CHANGED TO CORRESPOND WITH LABORATORY CLASSIFICATION AS NECESSARY.

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4

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Section:

Hole No. 10A-CHAPEL -9

Hole No. 10A-CHAPEL -10

Hole No. 10A-CHAPEL -11

DRILLING LOG

DIVISION

INSTALLATION

SHEET

SOUTHWESTERN

FORT WORTH DISTRICT

1

OF 1 SHEETS

1. PROJECT

CHAPEL/RELIGIOUS EDUCATION FAC.

11. SIZE AND TYPE OF BIT

SEE REMARKS

2. LOCATION

Coordinates or Station

12. DATUM FOR ELEVATION SHOWN

IBM or MSL

3. DRILLING AGENCY

GEDCO DRILLING & CORING, INC.

13. MANUFACTURER'S DESIGNATION OF DRILL

GARDNER-DENVER 1000

4. HOLE NOs

shown on drawing title and file number

10A-CHAPEL-9

14. TOTAL NUMBER CORE BOXES

0

5. NAME OF DRILLER

EDDY GARCIA

15. ELEVATION GROUND WATER

\*\* SEE REMARKS

6. DIRECTION OF HOLE

☒ VERTICAL ☐ INCLINED

DEG. FROM VERT.

16. DATE HOLE

STARTED

30 JAN 09

COMPLETED

30 JAN 09

7. THICKNESS OF OVERBURDEN

10.0'

17. ELEVATION TOP OF HOLE

8. DEPTH DRILLED INTO ROCK

0.0'

18. TOTAL CORE RECOVERY FOR BORING

N/A %

9. TOTAL DEPTH OF HOLE

10.0'

19. SIGNATURE OF INSPECTOR

EDWARD GILYARD

% MOISTURE CONTENT

DEPTH

LEGEND

CLASSIFICATION OF MATERIALS

(Description)

% CORE RECOVERY

BOX OR SAMPLE NO.

REMARKS

(Drilling time, water loss, depth of weathering, etc., if significant)

6.9

1

0.0' TO 2.3'

J-1

JAR SAMPLES:  
J-1: 0.0' TO 2.3'  
J-2: 2.3' TO 4.0'  
J-3: 4.0' TO 8.3'

2

2.3' TO 10.0'

J-2

9.5

3

CLAY-LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY TO MOIST, HARD, FAT LEAN CLAY (CL) WITH WEATHERED LIMESTONE SEAMS AND CALCAREOUS MATERIAL.

J-3

20.8

4

5

7

8

9

10

11

12

13

14

15

ENG FORM 1836

PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT

CHAPEL/RELIG. ED. FAC.

HOLE NO.

10A-CHAPEL-9

DRILLING LOG

DIVISION

INSTALLATION

SHEET

SOUTHWESTERN

FORT WORTH DISTRICT

1

OF 1 SHEETS

1. PROJECT

CHAPEL/RELIGIOUS EDUCATION FAC.

11. SIZE AND TYPE OF BIT

SEE REMARKS

2. LOCATION

Coordinates or Station

12. DATUM FOR ELEVATION SHOWN

IBM or MSL

3. DRILLING AGENCY

GEDCO DRILLING & CORING, INC.

13. MANUFACTURER'S DESIGNATION OF DRILL

GARDNER-DENVER 1000

4. HOLE NOs

shown on drawing title and file number

10A-CHAPEL-10

14. TOTAL NUMBER CORE BOXES

0

5. NAME OF DRILLER

EDDY GARCIA

15. ELEVATION GROUND WATER

\*\* SEE REMARKS

6. DIRECTION OF HOLE

☒ VERTICAL ☐ INCLINED

DEG. FROM VERT.

16. DATE HOLE

STARTED

30 JAN 09

COMPLETED

30 JAN 09

7. THICKNESS OF OVERBURDEN

7.2'

17. ELEVATION TOP OF HOLE

8. DEPTH DRILLED INTO ROCK

2.8'

18. TOTAL CORE RECOVERY FOR BORING

N/A %

9. TOTAL DEPTH OF HOLE

10.0'

19. SIGNATURE OF INSPECTOR

EDWARD GILYARD

% MOISTURE CONTENT

DEPTH

LEGEND

CLASSIFICATION OF MATERIALS

(Description)

% CORE RECOVERY

BOX OR SAMPLE NO.

REMARKS

(Drilling time, water loss, depth of weathering, etc., if significant)

5.5

1

0.0' TO 4.3'

J-1

JAR SAMPLES:  
J-1: 0.0' TO 1.8'  
J-2: 1.8' TO 4.3'  
J-3: 4.3' TO 7.2'  
J-4: 7.2' TO 10.0'

2

4.3' TO 7.2'

J-2

9.4

3

CLAY-LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY TO MOIST, HARD, LEAN CLAY (CL) WITH WEATHERED LIMESTONE SEAMS AND CALCAREOUS MATERIAL.

J-3

16.3

4

7.2' TO 10.0'

J-4

5

7

8

9

10

11

12

13

14

15

ENG FORM 1836

PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT

CHAPEL/RELIG. ED. FAC.

HOLE NO.

10A-CHAPEL-10

DRILLING LOG

DIVISION

INSTALLATION

SHEET

SOUTHWESTERN

FORT WORTH DISTRICT

1

OF 1 SHEETS

1. PROJECT

CHAPEL/RELIGIOUS EDUCATION FAC.

11. SIZE AND TYPE OF BIT

SEE REMARKS

2. LOCATION

Coordinates or Station

12. DATUM FOR ELEVATION SHOWN

IBM or MSL

3. DRILLING AGENCY

GEDCO DRILLING & CORING, INC.

13. MANUFACTURER'S DESIGNATION OF DRILL

GARDNER-DENVER 1000

4. HOLE NOs

shown on drawing title and file number

10A-CHAPEL-11

14. TOTAL NUMBER CORE BOXES

0

5. NAME OF DRILLER

EDDY GARCIA

15. ELEVATION GROUND WATER

\*\* SEE REMARKS

6. DIRECTION OF HOLE

☒ VERTICAL ☐ INCLINED

DEG. FROM VERT.

16. DATE HOLE

STARTED

30 JAN 09

COMPLETED

30 JAN 09

7. THICKNESS OF OVERBURDEN

10.0'

17. ELEVATION TOP OF HOLE

8. DEPTH DRILLED INTO ROCK

0.0'

18. TOTAL CORE RECOVERY FOR BORING

N/A %

9. TOTAL DEPTH OF HOLE

10.0'

19. SIGNATURE OF INSPECTOR

EDWARD GILYARD

% MOISTURE CONTENT

DEPTH

LEGEND

CLASSIFICATION OF MATERIALS

(Description)

% CORE RECOVERY

BOX OR SAMPLE NO.

REMARKS

(Drilling time, water loss, depth of weathering, etc., if significant)

24.9

1

0.0' TO 3.2'

J-1

JAR SAMPLES:  
J-1: 0.0' TO 3.2'  
J-2: 3.2' TO 6.0'  
J-3: 6.0' TO 8.9'

2

3.2' TO 10.0'

J-2

12.8

3

CLAY-LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY TO MOIST, HARD, FAT LEAN CLAY (CH/CL) WITH WEATHERED LIMESTONE SEAMS AND CALCAREOUS MATERIAL.

J-3

14.3

4

5

7

8

9

10

11

12

13

14

15

ENG FORM 1836

PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT

CHAPEL/RELIG. ED. FAC.

HOLE NO.

10A-CHAPEL-11

NOTES:

1. USE THIS SHEET FOR BORING LOGS ONLY.

2. MOISTURE CONTENT, WHERE SHOWN, IS EXPRESSED AS PERCENT DRY WEIGHT AT TIME OF LABORATORY CLASSIFICATION.

3. LEGEND SHOWS OVERBURDEN MATERIALS CLASSIFIED ACCORDING TO ASTM D 2487 AND ASTM D 2488.

4. DESCRIPTION OF OVERBURDEN MATERIALS CHANGED TO CORRESPOND WITH LABORATORY CLASSIFICATION AS NECESSARY.

US Army Corps of Engineers

Fort Worth District

DESIGNED BY

K. MCLESKEY

DRAWN BY

K. MCLESKEY

REVIEWED BY

L. PERRIN

SUBMITTED BY

LESLIE L. PERRIN, P.E.

CHIEF, GEOTECHNICAL SECTION

DATE

SOl No.

CONT. No.

FILE NAME

DATE

POST CODE

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

FORT HOOD, TEXAS CHAPEL COMPLEX

PN: 025033

LOGS OF BORINGS - 4 OF 5

Sheet reference number: B204

1

2

3

4

5

Section:

Hole No. 10A-CHAPEL -12

Hole No. 10A-CHAPEL -13

Hole No. 10A-CHAPEL -14

DRILLING LOG

DIVISION

INSTALLATION

SHEET

SOUTHWESTERN

FORT WORTH DISTRICT

1

OF 1 SHEETS

1. PROJECT

CHAPEL/RELIGIOUS EDUCATION FAC.

10. SIZE AND TYPE OF BIT

SEE REMARKS

2. LOCATION

Coordinates or Station

11. DATUM FOR ELEVATION SHOWN

IBM or MSL

3. DRILLING AGENCY

GEDCO DRILLING & CORING, INC.

12. MANUFACTURER'S DESIGNATION OF DRILL

GARDNER-DENVER 1000

4. HOLE NOs

shown on drawing title and file number

10A-CHAPEL-12

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN

DISTURBED

3

UNDISTURBED

0

5. NAME OF DRILLER

EDDY GARCIA

14. TOTAL NUMBER CORE BOXES

0

6. DIRECTION OF HOLE

VERTICAL

INCLINED

DEG. FROM VERT.

15. ELEVATION GROUND WATER

SEE REMARKS

7. THICKNESS OF OVERBURDEN

10.0'

16. DATE HOLE

STARTED

30 JAN 09

COMPLETED

30 JAN 09

8. DEPTH DRILLED INTO ROCK

0.0'

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING

N/A %

9. TOTAL DEPTH OF HOLE

10.0'

19. SIGNATURE OF INSPECTOR

EDWARD GILYARD

MOISTURE CONTENT

DEPTH

LEGEND

CLASSIFICATION OF MATERIALS

DESCRIPTION

BOX OR SAMPLE NO.

REMARKS

Drilling time, water loss, depth of weathering, etc., if significant

17.7

1

0.0' TO 2.3'

CLAY-BROWN TO LIGHT BROWN, DRY, HARD, FAT CLAY (CH).

J-1

J-1: 0.0' TO 2.3'

J-2: 2.3' TO 6.7'

J-3: 6.7' TO 10.0'

2.3' TO 10.0'

CLAY-LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY TO MOIST, HARD, FAT CLAY (CH) WITH WEATHERED LIMESTONE SEAMS AND CALCAREOUS MATERIAL.

J-2

11.1

5

BORING TERMINATED AT 10.0'

BORING LOCATION:  
X-618510 Y-3445355  
LAT. N31°8'10.1"  
LONG. W97°45'24.8"

J-3

\*0.0' TO 10.0' -  
5" ROLLER CONE BIT.

\*\* NO GROUNDWATER MEASURED UPON COMPLETION.

19.7

9

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

MAR 71

PROJECT

CHAPEL/RELIG. ED. FAC.

HOLE NO.

10A-CHAPEL-12

DRILLING LOG

DIVISION

INSTALLATION

SHEET

SOUTHWESTERN

FORT WORTH DISTRICT

1

OF 1 SHEETS

1. PROJECT

CHAPEL/RELIGIOUS EDUCATION FAC.

10. SIZE AND TYPE OF BIT

SEE REMARKS

2. LOCATION

Coordinates or Station

11. DATUM FOR ELEVATION SHOWN

IBM or MSL

3. DRILLING AGENCY

GEDCO DRILLING & CORING, INC.

12. MANUFACTURER'S DESIGNATION OF DRILL

GARDNER-DENVER 1000

4. HOLE NOs

shown on drawing title and file number

10A-CHAPEL-13

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN

DISTURBED

3

UNDISTURBED

0

5. NAME OF DRILLER

EDDY GARCIA

14. TOTAL NUMBER CORE BOXES

0

6. DIRECTION OF HOLE

VERTICAL

INCLINED

DEG. FROM VERT.

15. ELEVATION GROUND WATER

SEE REMARKS

7. THICKNESS OF OVERBURDEN

10.0'

16. DATE HOLE

STARTED

30 JAN 09

COMPLETED

30 JAN 09

8. DEPTH DRILLED INTO ROCK

0.0'

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING

N/A %

9. TOTAL DEPTH OF HOLE

10.0'

19. SIGNATURE OF INSPECTOR

EDWARD GILYARD

MOISTURE CONTENT

DEPTH

LEGEND

CLASSIFICATION OF MATERIALS

DESCRIPTION

BOX OR SAMPLE NO.

REMARKS

Drilling time, water loss, depth of weathering, etc., if significant

15.1

1

0.0' TO 4.2'

CLAY-BROWN TO LIGHT BROWN, DRY, HARD, FAT/LEAN CLAY (CH/CL) WITH SAND.

J-1

J-1: 0.0' TO 0.9'

J-2: 0.9' TO 4.2'

J-3: 4.2' TO 8.7'

4.2' TO 10.0'

CLAY-LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY TO MOIST, HARD, SANDY LEAN CLAY (CL) WITH WEATHERED LIMESTONE SEAMS AND CALCAREOUS MATERIAL.

J-2

10.0

3

BORING TERMINATED AT 10.0'

BORING LOCATION:  
X-618519 Y-3445315  
LAT. N31°8'8.8"  
LONG. W97°45'24.5"

J-3

\*0.0' TO 10.0' -  
5" ROLLER CONE BIT.

\*\* NO GROUNDWATER MEASURED UPON COMPLETION.

15.2

8

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

MAR 71

PROJECT

CHAPEL/RELIG. ED. FAC.

HOLE NO.

10A-CHAPEL-13

DRILLING LOG

DIVISION

INSTALLATION

SHEET

SOUTHWESTERN

FORT WORTH DISTRICT

1

OF 1 SHEETS

1. PROJECT

CHAPEL/RELIGIOUS EDUCATION FAC.

10. SIZE AND TYPE OF BIT

SEE REMARKS

2. LOCATION

Coordinates or Station

11. DATUM FOR ELEVATION SHOWN

IBM or MSL

3. DRILLING AGENCY

GEDCO DRILLING & CORING, INC.

12. MANUFACTURER'S DESIGNATION OF DRILL

GARDNER-DENVER 1000

4. HOLE NOs

shown on drawing title and file number

10A-CHAPEL-14

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN

DISTURBED

3

UNDISTURBED

0

5. NAME OF DRILLER

EDDY GARCIA

14. TOTAL NUMBER CORE BOXES

0

6. DIRECTION OF HOLE

VERTICAL

INCLINED

DEG. FROM VERT.

15. ELEVATION GROUND WATER

SEE REMARKS

7. THICKNESS OF OVERBURDEN

10.0'

16. DATE HOLE

STARTED

30 JAN 09

COMPLETED

30 JAN 09

8. DEPTH DRILLED INTO ROCK

0.0'

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING

N/A %

9. TOTAL DEPTH OF HOLE

10.0'

19. SIGNATURE OF INSPECTOR

EDWARD GILYARD

MOISTURE CONTENT

DEPTH

LEGEND

CLASSIFICATION OF MATERIALS

DESCRIPTION

BOX OR SAMPLE NO.

REMARKS

Drilling time, water loss, depth of weathering, etc., if significant

16.5

2

0.0' TO 0.3'

VISUAL

ASPHALT

J-1

J-1: 0.5' TO 3.9'

J-2: 3.9' TO 6.1'

J-3: 6.1' TO 10.0'

0.3' TO 0.5'

BASE MATERIAL-CRUSHED LIMESTONE.

J-2

0.5' TO 3.9'

CLAY-LIGHT BROWN, DRY, HARD, FAT CLAY (CH) WITH SAND AND LIMESTONE GRAVEL.

J-2

3.9' TO 10.0'

CLAY-LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY TO MOIST, HARD, LEAN CLAY (CL) WITH WEATHERED LIMESTONE SEAMS.

J-3

13.7

8

BORING TERMINATED AT 10.0'

BORING LOCATION:  
X-618431 Y-3445279  
LAT. N31°8'7.7"  
LONG. W97°45'27.8"

J-3

\*0.0' TO 10.0' -  
5" ROLLER CONE BIT.

\*\* NO GROUNDWATER MEASURED UPON COMPLETION.

25.3

5

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

MAR 71

PROJECT

CHAPEL/RELIG. ED. FAC.

HOLE NO.

10A-CHAPEL-14

US Army Corps of Engineers  
Fort Worth District

DESIGN FILE: \$cadd file name\$

Rev.  
Date  
SoNo.  
Cont. No.  
Submitted by:  
LESLIE L. PERRIN, P.E.  
Chief, Geotechnical Section

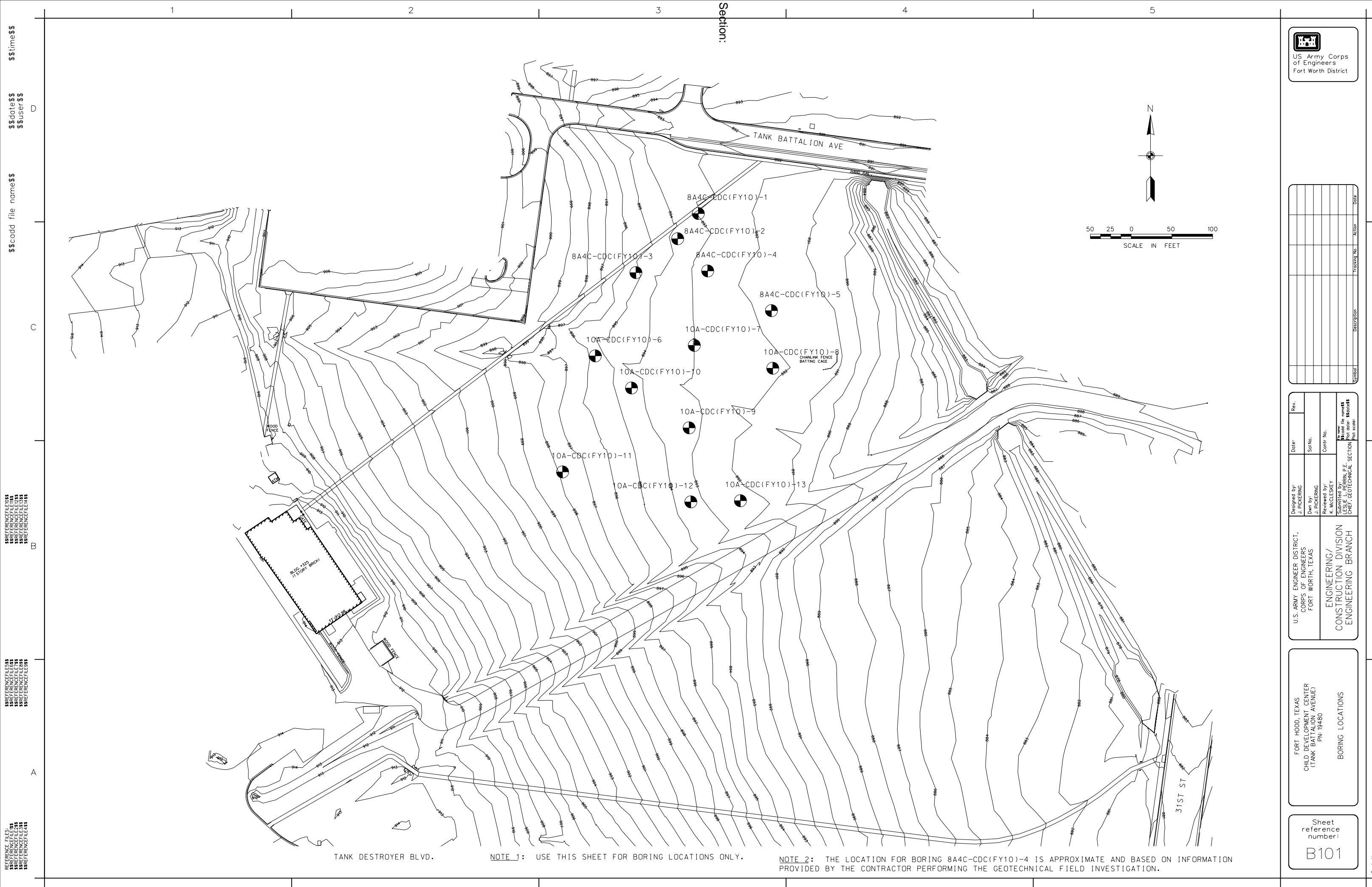
U.S. ARMY ENGINEER DISTRICT,  
CORPS OF ENGINEERS  
FORT WORTH, TEXAS

ENGINEERING/  
CONSTRUCTION DIVISION  
DESIGN BRANCH

FORT HOOD, TEXAS  
CHAPEL COMPLEX  
PN: 025033

LOGS OF BORINGS - 5 OF 5

Sheet  
reference  
number:  
B205



REFERENCE FILES:  
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\$REFERENCEFILE2\$  
\$REFERENCEFILE3\$  
\$REFERENCEFILE4\$  
\$REFERENCEFILE5\$  
\$REFERENCEFILE6\$  
\$REFERENCEFILE7\$  
\$REFERENCEFILE8\$  
\$REFERENCEFILE9\$  
\$REFERENCEFILE10\$  
\$REFERENCEFILE11\$  
\$REFERENCEFILE12\$  
\$REFERENCEFILE13\$  
\$REFERENCEFILE14\$  
\$REFERENCEFILE15\$

\$CADD file name\$

\$date\$  
\$user\$

\$time\$

TANK DESTROYER BLVD.

NOTE 1: USE THIS SHEET FOR BORING LOCATIONS ONLY.

NOTE 2: THE LOCATION FOR BORING 8A4C-CDC(FY10)-4 IS APPROXIMATE AND BASED ON INFORMATION PROVIDED BY THE CONTRACTOR PERFORMING THE GEOTECHNICAL FIELD INVESTIGATION.

FORT HOOD, TEXAS  
CHILD DEVELOPMENT CENTER  
(TANK BATTALION AVENUE)  
PN: 19480

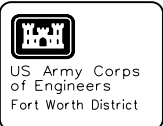
BORING LOCATIONS

U.S. ARMY ENGINEER DISTRICT,  
CORPS OF ENGINEERS  
FORT WORTH, TEXAS

ENGINEERING/  
CONSTRUCTION DIVISION  
ENGINEERING BRANCH

Designed by: J. PICKERING	Date:	Rev.
Dwn by: J. PICKERING	Sol No.	
Reviewed by: K. MCLESKEY	Contr. No.	
Submitted by: LESLIE L. PERRIN, P.E. CHIEF, GEOTECHNICAL SECTION	Plot date:	Plot scale:

Symbol	Description	Tracking No.	Action	Date



US Army Corps  
of Engineers  
Fort Worth District

Sheet  
reference  
number:  
  
B101

Contr. No.

DESIGN FILE: \$CADD file name\$

1

2

3

4

5

Section:

1

2

3

4

5

Drilling Log

Drilling Log (Cont Sheet)

Drilling Log

Drilling Log (Cont Sheet)

Drilling Log

Drilling Log (Cont Sheet)

Drilling Log

Drilling Log (Cont Sheet)

Drilling Log

Drilling Log (Cont Sheet)

Drilling Log

Drilling Log (Cont Sheet)

US Army Corps of Engineers

Fort Worth District

U.S. Army Engineer District, Fort Worth, Texas

Engineering/Construction Division

Engineering Branch

Fort Hood, Texas

Child Development Center



Logs of Borings - 1 of 3

Sheet reference number: B201

DESIGN FILE: 15-cadd file name15

NOTE: USE THIS SHEET FOR BORING LOGS ONLY.



DRILLING LOG		DIVISION SOUTHWESTERN	INSTALLATION FORT WORTH DISTRICT		Hole No. 10ACDC(FY10)-7		
			SHEET OF 1 SHEETS				
1. PROJECT CDC (TBAI (PN19480), FT HOOD			10. SIZE AND TYPE OF BIT 8" Hollow Stem Auger & 4" Core				
2. LOCATION (Coordinates or Stage) N. 31.1361111111 E. 97.7554444444			11. DATUM FOR ELEVATION SHOWN (FIM or MSL) TBM				
3. DRILLING AGENCY Kearney-Wachter Consultants, Inc.			12. MANUFACTURER'S DESIGNATION OF DRILL Mach B59				
4. HOLE NO. (As shown on drawing site and file number) 10ACDC(FY10)-7			13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 0		14. UNDISTURBED 2		
5. NAME OF DRILLER Craig Perryman			14. TOTAL NUMBER CORE BONES N/A		15. ELEVATION GROUND WATER 0		
6. DIRECTION OF HOLE DECLIN. <input type="checkbox"/> BALINED <input type="checkbox"/> DEC. FROM VERT. <input type="checkbox"/>			16. DATE HOLE STARTED 27-Jan-09 COMPLETED 27-Jan-09		17. ELEVATION TOP OF HOLE 1000		
7. THICKNESS OF OVERBURDEN 3			18. TOTAL CORE RECOVERY FOR BORING %				
8. DEPTH DRILLED INTO ROCK 6.5			19. GEOLOGIST Brent Foshee				
9. TOTAL DEPTH OF HOLE 10							
DEPTH d	LEGEND b	CLASSIFICATION OF MATERIALS (Description)	BLOW COUNT s	% RECOVERY e	SAMPLE INTERVAL f	MOISTURE g	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) h
0.0		CLAY (LH), Fat, Hard, Dark Brown, Moist, with sand					
3.4					3.0 5.0		
		LIMESTONE, Decomposed, Soft, Chalky, Pale Yellow					
					8.0 10.0		
10.0							
NOTES: 1. Groundwater was not encountered during drilling operations. 2. Borehole was backfilled with grout. 3. Assumes ground surface elevation of 1000 ft.							

[illegible]

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS	Designed by:	Date:	Rev.
	J. PICKERING		
	Drawn by:	Sol No.	
	J. PICKERING		
ENGINEERING/ CONSTRUCTION DIVISION ENGINEERING BRANCH	Reviewed by:	Contr. No.	
	K. MCMILLIN		
	Submitted by:		
	W. L. FERNANDEZ, P.E. CHIEF, GEOTECHNICAL SECTION	14-00000 file number: 45 Plot date: \$540455 Plot scale:	

FORT HOOD, TEXAS  
CHILD DEVELOPMENT CENTER  
(TANK BATTALION AVENUE)  
PN: 19480

LOGS OF BORINGS - 2 OF 3

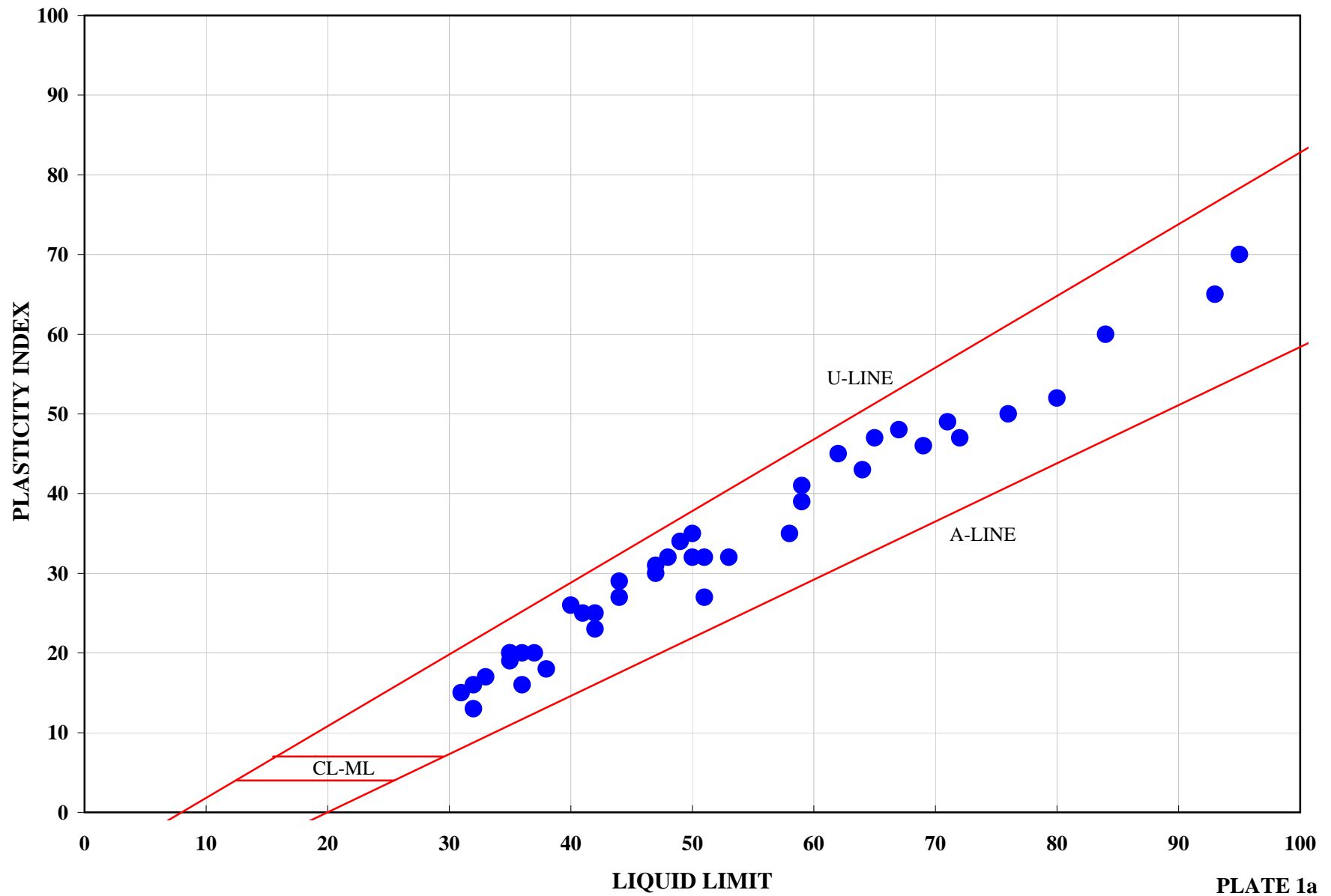
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reference  
number:  
B202



## **APPENDIX B**

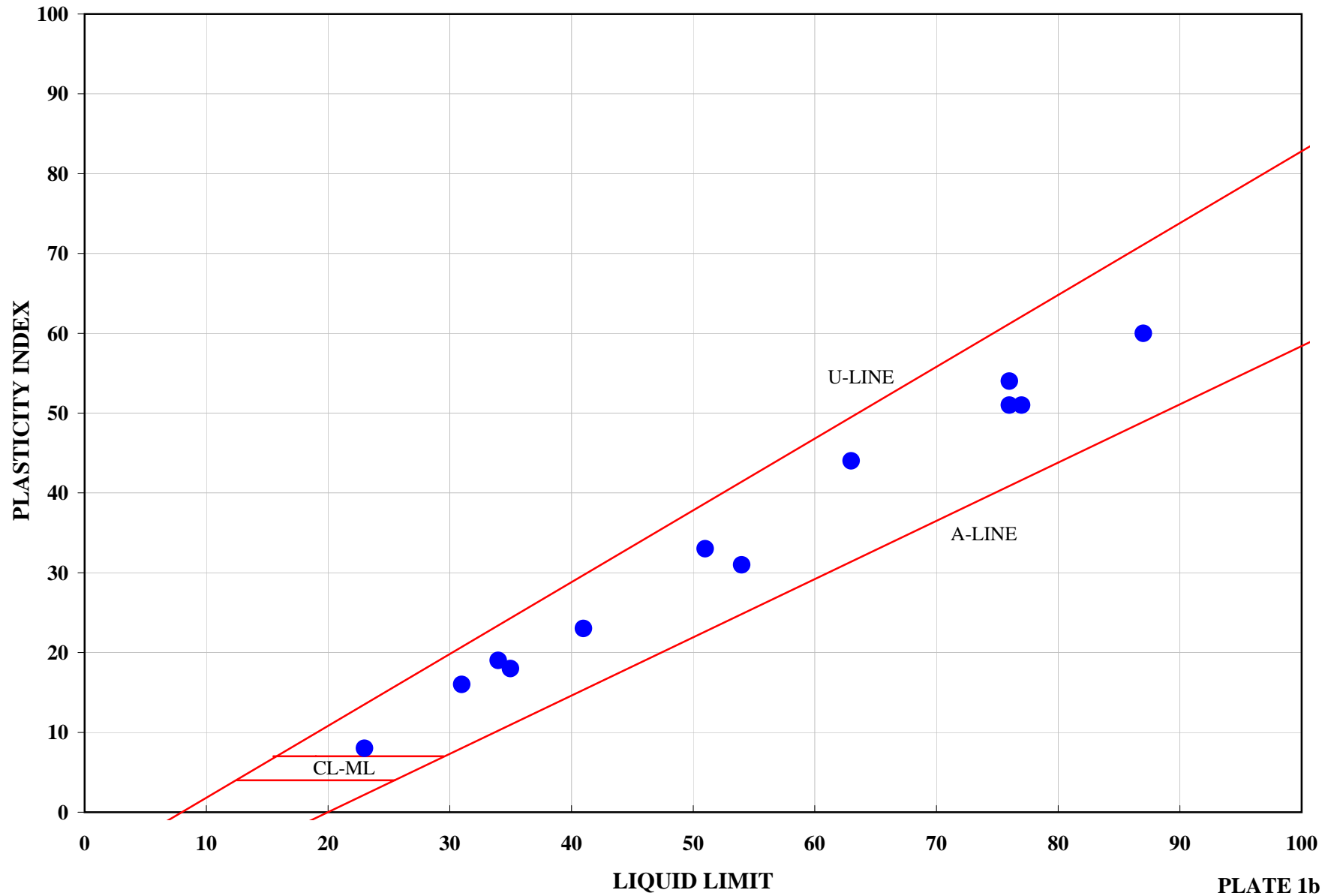
### **LABORATORY TESTING DATA PLOTS**

# CHAPEL and RELIGIOUS EDUCATION FACILITY PLASTICITY CHART



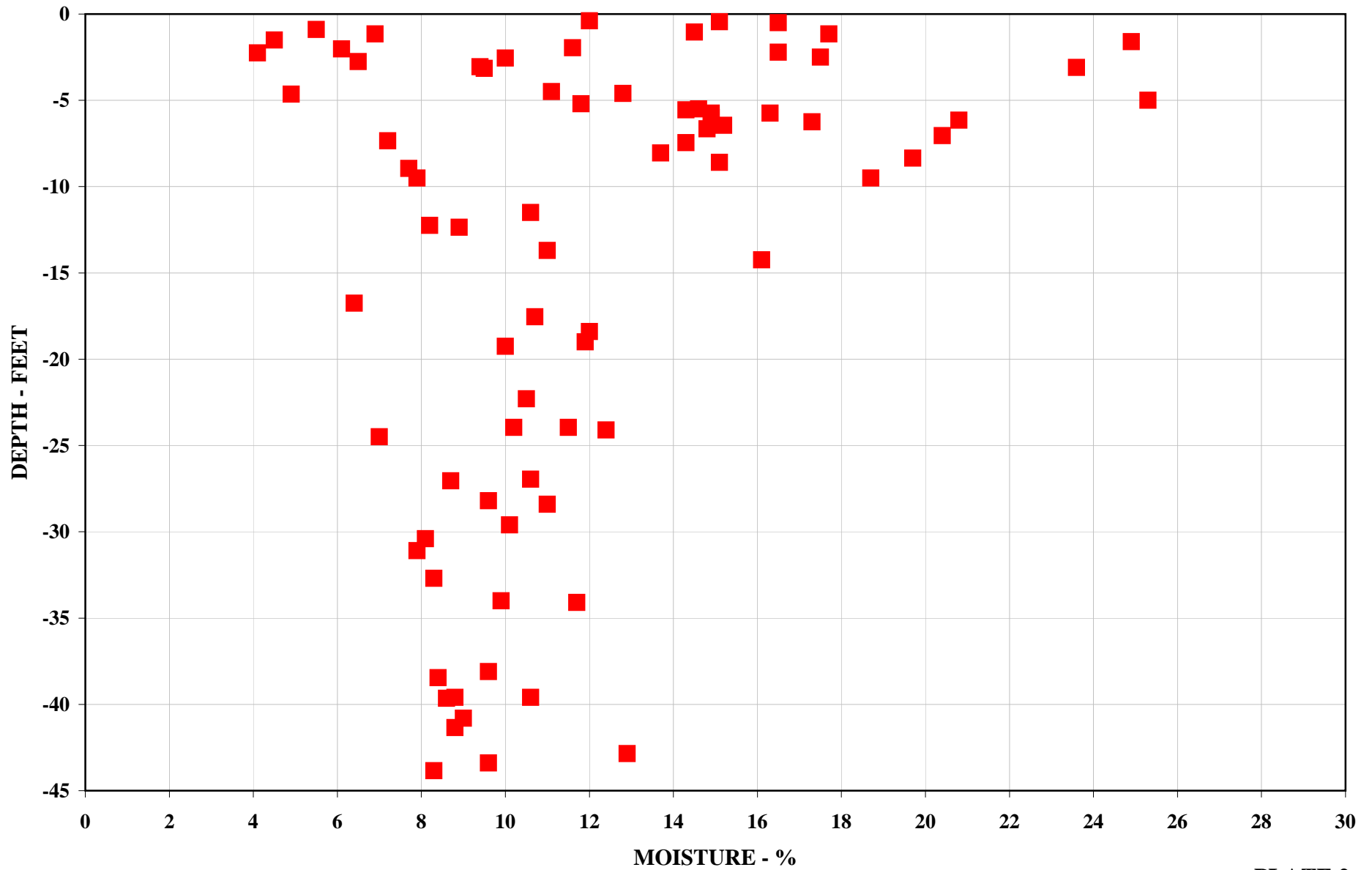
# CHILD DEVELOPMENT CENTER (0 - 5 YEARS) - TANK BATTALION AVENUE

## PLASTICITY CHART



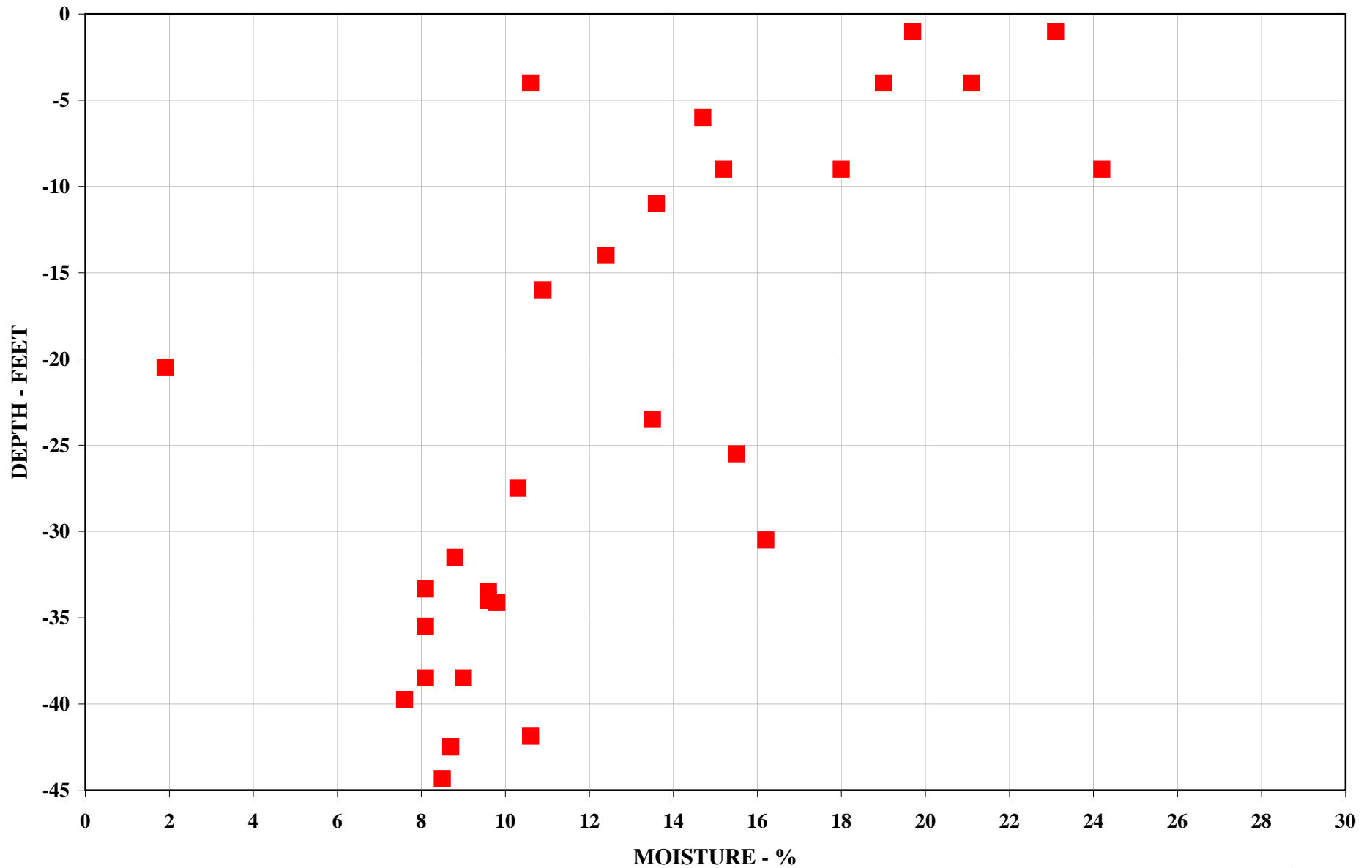
Section:

# CHAPEL and RELIGIOUS EDUCATION FACILITY MOISTURE CONTENT VS DEPTH



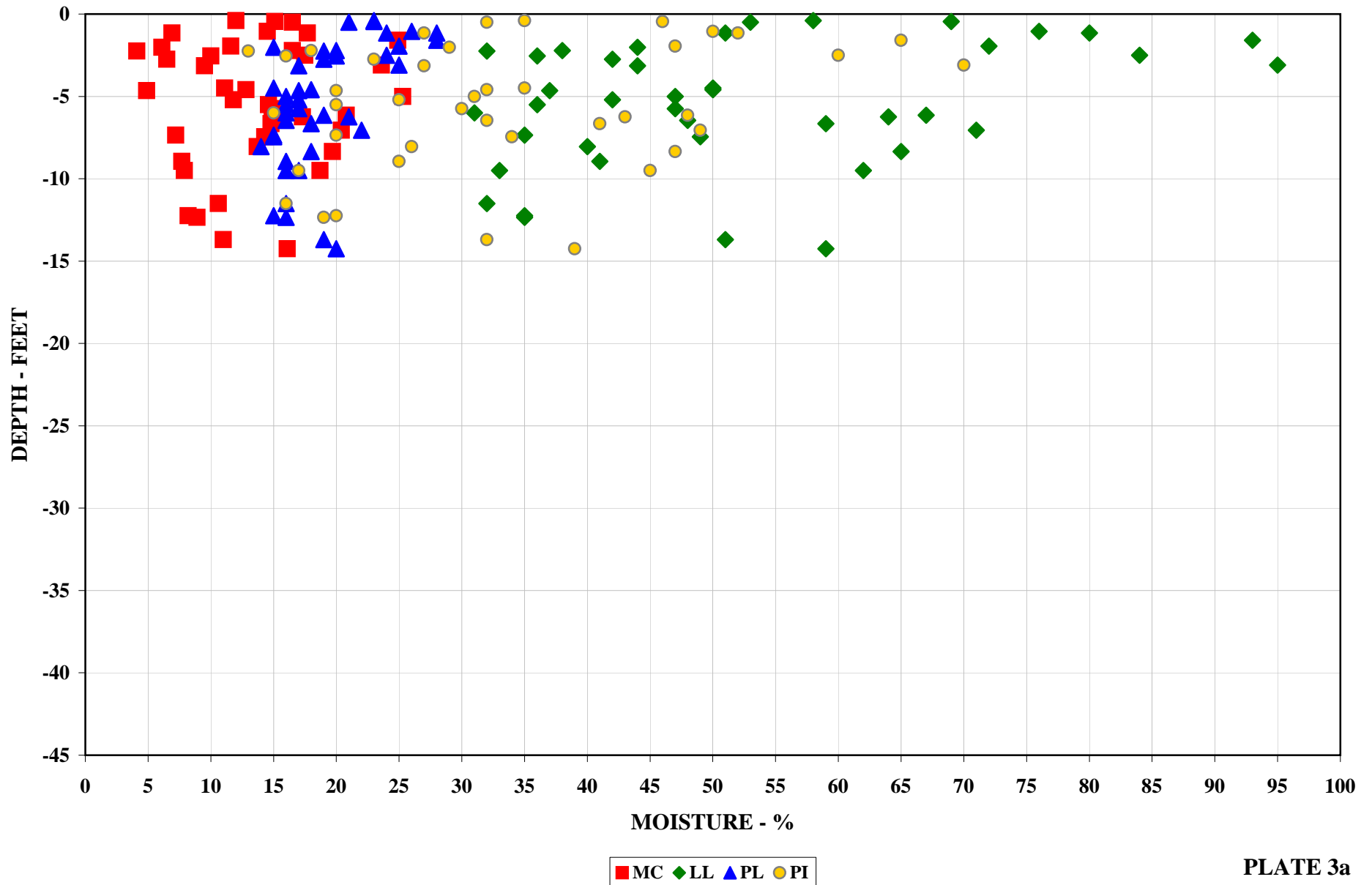
Section:

# CHILD DEVELOPMENT CENTER (0 - 5 YEARS) - TANK BATTALION AVENUE MOISTURE CONTENT VS DEPTH



Section:

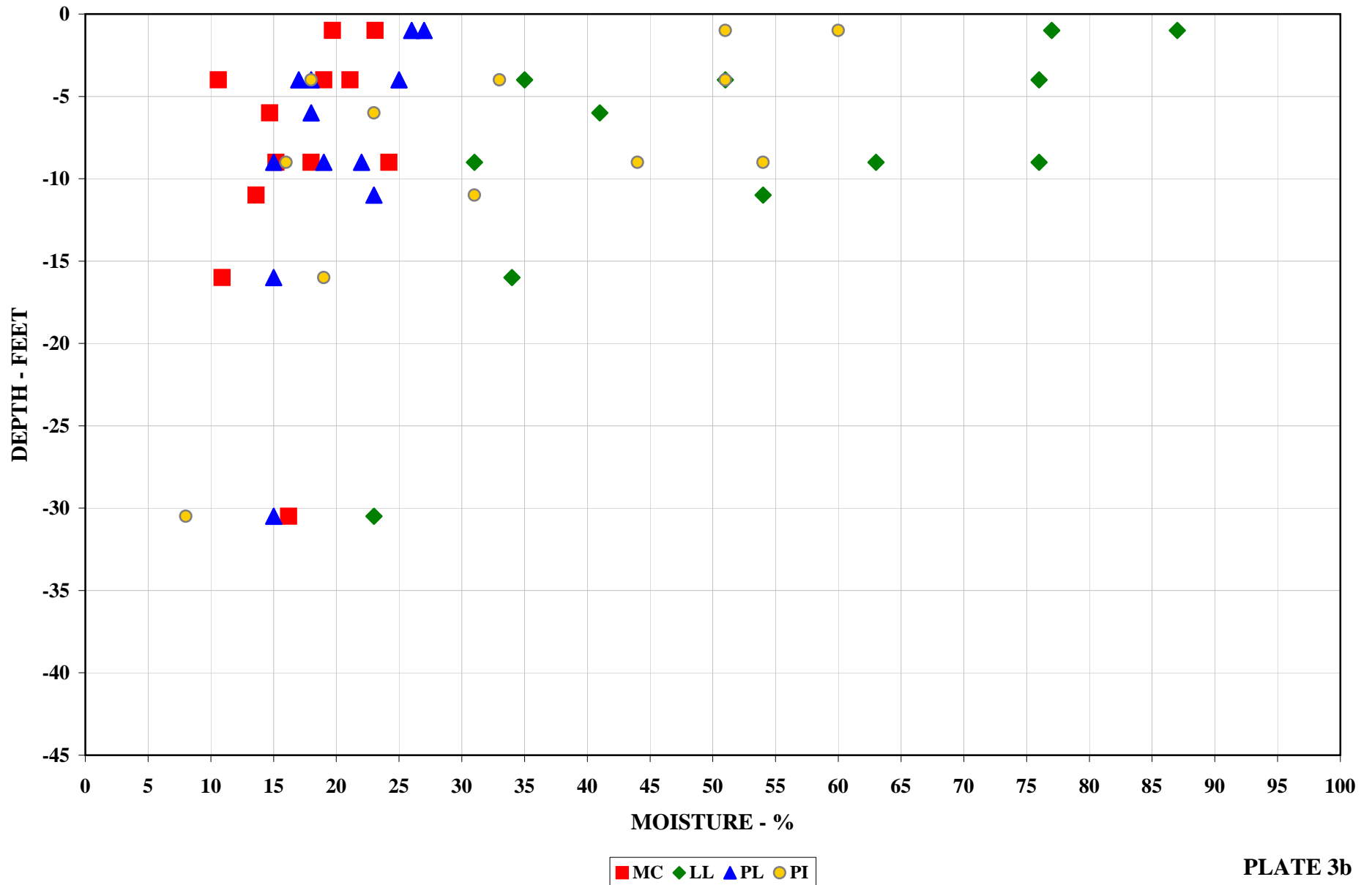
# CHAPEL and RELIGIOUS EDUCATION FACILITY ATTERBERG LIMITS VS DEPTH





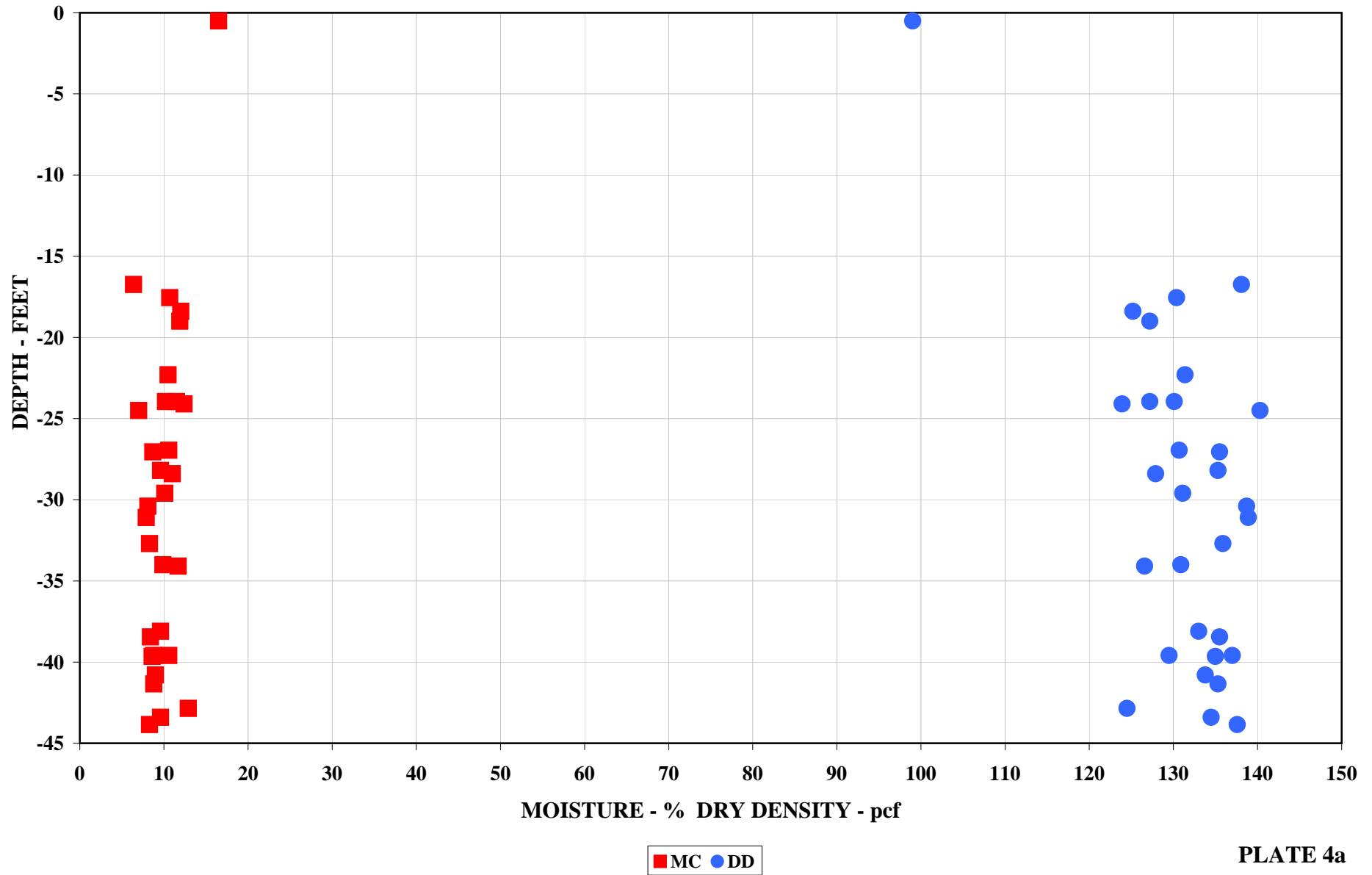
Section:

# CHILD DEVELOPMENT CENTER (0 - 5 YEARS) - TANK BATTALION AVENUE ATTERBERG LIMITS VS DEPTH



Section:

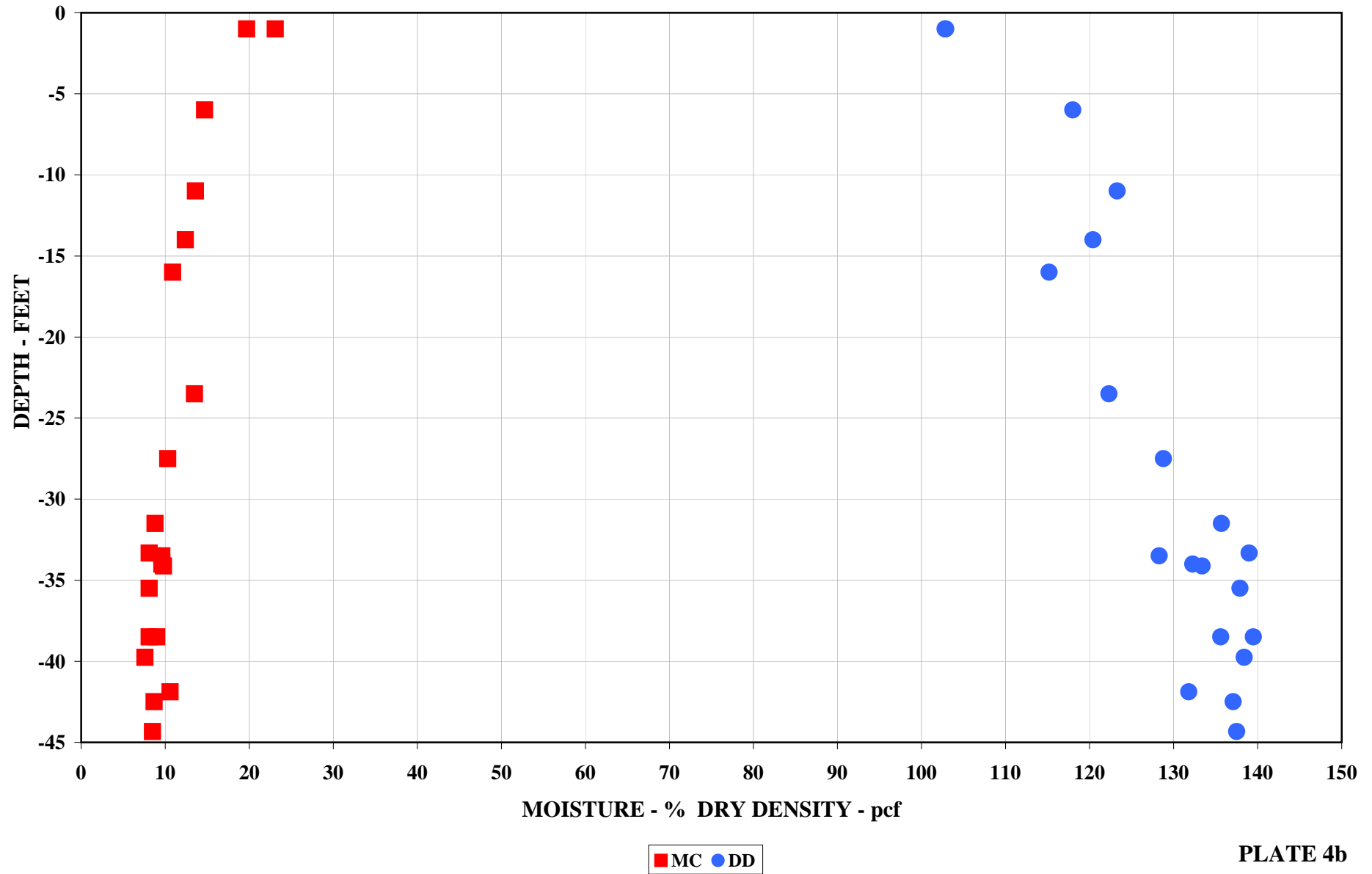
# CHAPEL and RELIGIOUS EDUCATION FACILITY MOISTURE CONTENT - DRY DENSITY VS DEPTH



Section:

# CHILD DEVELOPMENT CENTER (0 - 5 YEARS) - TANK BATTALION AVENUE

## MOISTURE CONTENT - DRY DENSITY VS DEPTH



Section:

# CHAPEL and RELIGIOUS EDUCATION FACILITY ULTIMATE COMPRESSIVE STRENGTH VS DEPTH

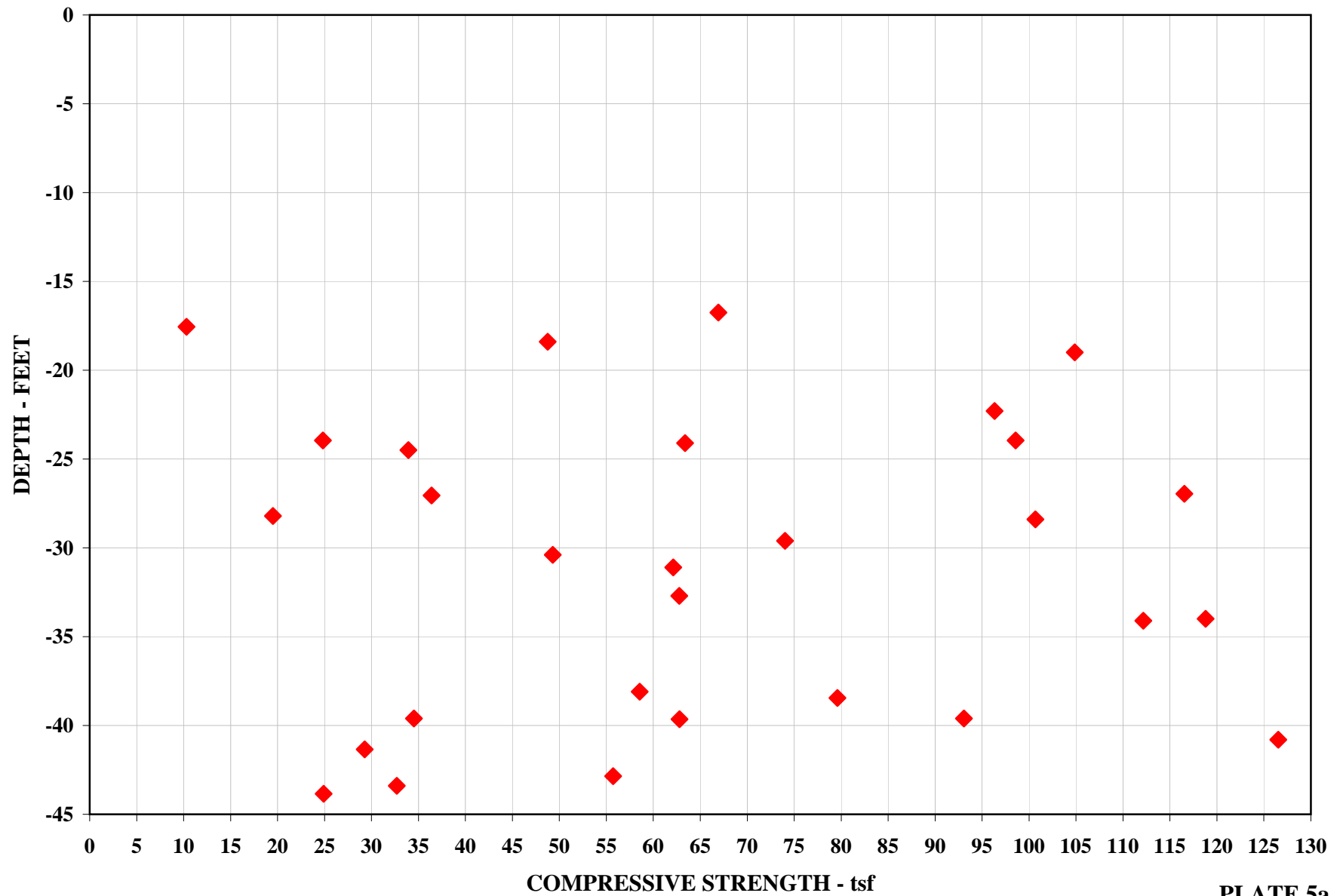
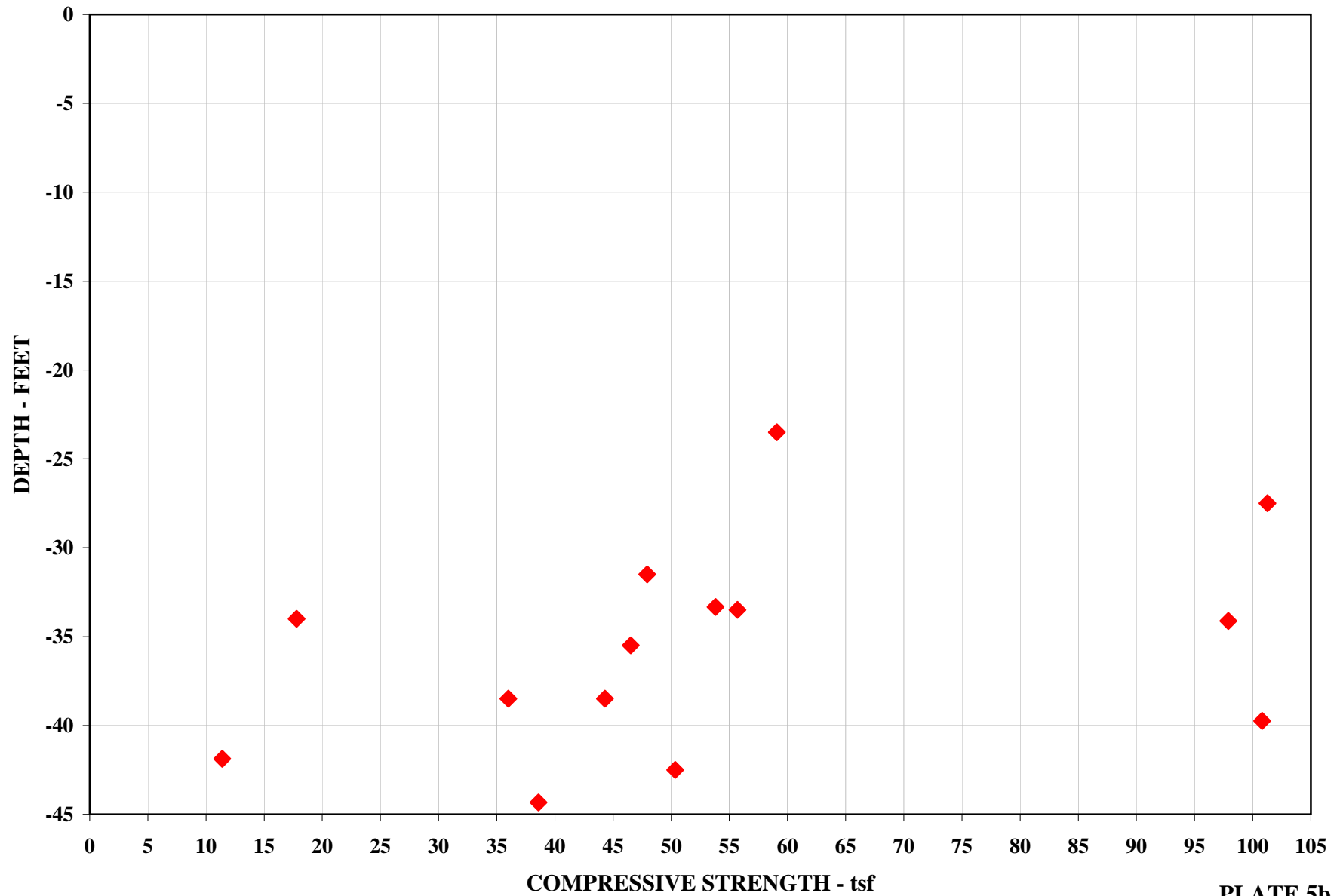


PLATE 5a

# CHILD DEVELOPMENT CENTER (0 - 5 YEARS) - TANK BATTALION AVENUE

## ULTIMATE COMPRESSIVE STRENGTH VS DEPTH



## **APPENDIX C**

### **LABORATORY TESTING DATA**

**SUMMARY OF LABORATORY TEST RESULTS**  
**LABORATORY TESTING SERVICES**  
**CHAPEL AND RELIGIOUS EDUCATION FACILITY**  
**FORT HOOD, TEXAS**

Boring No.	Sample No.	Sample Depth (ft.-in.)	Visual Description & Unified Soil Classification (ASTM D-2488)		Percent Passing Sieve							
					#4	#10	#20	#40	#60	#80	#100	#200
8A4C-CHAPEL-1	J-1	0-2.1	Brown clay	CH	99.8	98.6	96.7	95.3	84.2	93.5	93.1	91.9
	J-2	3.4-5.9	Tan clay with sand	CL	95.4	89.7	85.7	83.1	80.9	79.2	78.5	76.1
	J-3	5.9-7.4	Tan clay	CH	99.5	98.0	96.7	96.0	95.4	94.9	94.7	93.5
	J-4	12.3-15.1	Tan and light brown clay	CH	--	--	--	--	--	--	--	--
	C-1	17.2-17.9	Tan and gray weathered limestone	N/A	--	--	--	--	--	--	--	--
	C-2	23.7-24.5	Light gray limestone	N/A	--	--	--	--	--	--	--	--
	C-3	29.2-30	Gray limestone	N/A	--	--	--	--	--	--	--	--
	C-4	30-30.8	Gray limestone	N/A	--	--	--	--	--	--	--	--
	C-5	39.3-40	Gray limestone	N/A	--	--	--	--	--	--	--	--
	C-6	42.5-43.2	Light gray limestone	N/A	--	--	--	--	--	--	--	--
8A4C-CHAPEL-2	J-1	0-3.9	Light brown clay	CH	98.9	97.3	95.9	94.7	94.4	93.9	93.6	92.5
	J-2	5-7	Tan and light brown clay	CL	100.0	98.9	98.1	96.2	94.3	92.4	91.5	86.7
	J-3	11.7-13	Tan and light gray clay	CL	--	--	--	--	--	--	--	--
	C-1	18.1-18.7	Tan weathered limestone	N/A	--	--	--	--	--	--	--	--
	C-2	23.6-24.3	Tan weathered limestone	N/A	--	--	--	--	--	--	--	--
	C-3	26.7-27.4	Gray limestone	N/A	--	--	--	--	--	--	--	--
	C-4	32.3-33.1	Gray limestone	N/A	--	--	--	--	--	--	--	--
	C-5	38.2-38.7	Light gray limestone	N/A	--	--	--	--	--	--	--	--
	C-6	41-41.7	Gray limestone	N/A	--	--	--	--	--	--	--	--
8A4C-CHAPEL-3	ST-1	0-1	Grayish brown clay with sand	CH	99.1	93.4	86.3	80.7	77.5	75.6	74.8	72.2
	J-1	1-3.5	Tan sandy clay with calcareous nodules	CL	92.6	81.9	73.4	68.7	66.0	64.3	63.7	61.6
	J-2	5-6.5	Tan sandy clay	CL	91.5	88.2	83.9	82.5	81.7	81.2	81.0	79.7
	J-3	9-10	Light brown clay	CH	99.4	97.6	96.0	95.0	94.0	93.3	92.9	91.1
	J-4	13.5-15	Light brown clay	CH	--	--	--	--	--	--	--	--
	J-5	18.5-20	Tan and light gray limestone fragments	N/A	--	--	--	--	--	--	--	--
	C-1	24.2-24.8	Tan and gray weathered limestone	N/A	--	--	--	--	--	--	--	--
	C-2	28-28.8	Gray limestone	N/A	--	--	--	--	--	--	--	--
	C-3	33.6-34.4	Gray limestone	N/A	--	--	--	--	--	--	--	--
	C-4	39.2-40	Gray limestone	N/A	--	--	--	--	--	--	--	--
	C-5	43.5-44.2	Gray limestone	N/A	--	--	--	--	--	--	--	--

**SUMMARY OF LABORATORY TEST RESULTS**  
**LABORATORY TESTING SERVICES**  
**CHAPEL AND RELIGIOUS EDUCATION FACILITY**  
**FORT HOOD, TEXAS**

Boring No.	Sample No.	Sample Depth (ft.-in.)	Visual Description & Unified Soil Classification (ASTM D-2488)		Percent Passing Sieve							
					#4	#10	#20	#40	#60	#80	#100	#200
8A4C-CHAPEL-4	J-1	0-8	Light brown sandy clay	CH	93.9	84.7	78.3	74.4	72.2	70.9	70.4	68.4
	J-2	2-3.5	Light tan calcareous clay with sand	CL	98.2	94.0	90.9	89.0	97.2	85.8	85.3	83.0
	J-3	5-7.5	Light tan calcareous clay	CH	94.8	92.6	91.2	90.5	89.9	89.4	90.2	88.2
	J-4	11.5-13	Tan silty clay	CL	--	--	--	--	--	--	--	--
	C-1	16.5-17	Tan fossiliferous limestone with clay/shale inclusions	N/A	--	--	--	--	--	--	--	--
	C-2	23.6-24.3	Light gray limestone	N/A	--	--	--	--	--	--	--	--
	C-3	26.5-27.4	Light gray limestone	N/A	--	--	--	--	--	--	--	--
	C-4	30.7-31.5	Gray limestone	N/A	--	--	--	--	--	--	--	--
	C-5	39.2-10	Light gray limestone	N/A	--	--	--	--	--	--	--	--
	C-6	40.4-41.2	Light gray limestone	N/A	--	--	--	--	--	--	--	--
8A4C-CHAPEL-5	J-1	2-3	Brown clay	CH	99.6	98.7	97.4	96.5	95.8	95.2	94.6	91.8
	J-2	5-6	Tan calcareous clay with sand	CL	95.9	90.3	86.7	84.5	82.4	80.5	79.7	75.4
	J-3	9-10	Tan calcareous clay with sand	CL	--	--	--	--	--	--	--	--
	J-4	11-12	Tan calcareous clay with limestone fragments	CL	--	--	--	--	--	--	--	--
	C-1	18.6-19.4	Tan weathered limestone	N/A	--	--	--	--	--	--	--	--
	C-2	21.9-22.7	Gray limestone	N/A	--	--	--	--	--	--	--	--
	C-3	27.9-28.5	Gray fossiliferous limestone	N/A	--	--	--	--	--	--	--	--
	C-4	33.7-34.5	Light gray limestone	N/A	--	--	--	--	--	--	--	--
	C-5	37.8-38.4	Light gray limestone	N/A	--	--	--	--	--	--	--	--
	C-6	43-43.8	Gray limestone	N/A	--	--	--	--	--	--	--	--
10A-CHAPEL-6	J-1	0-6.2	Brown clay	CH	99.7	97.7	95.7	94.5	93.7	93.3	93.1	92.5
	J-2	6.2-7.9	Tan sandy clay with limestone fragments	CH	92.6	83.4	76.7	72.9	70.8	69.4	68.9	67.1
	J-3	7.9-10	Tan calcareous clay	CL	--	--	--	--	--	--	--	--
10A-CHAPEL-7	J-1	.32-2.7	Light brown clay with sand	CH	--	--	--	--	--	--	--	--
	J-2	4.8-6.3	Tan calcareous clay	CL	--	--	--	--	--	--	--	--
10A-CHAPEL-8	J-1	.25-3.8	Light brown sandy clay with gravel	CL	85.4	69.3	58.6	55.2	54.0	53.3	53.0	51.0
	J-2	3.8-6.6	Light brown clay	CL	98.9	97.6	96.7	96.2	95.9	95.6	95.5	94.5
	J-3	7.3-8	Tan calcareous clay with sand	CL	--	--	--	--	--	--	--	--



**SUMMARY OF LABORATORY TEST RESULTS**  
**LABORATORY TESTING SERVICES**  
**CHAPEL AND RELIGIOUS EDUCATION FACILITY**  
**FORT HOOD, TEXAS**

Boring No.	Sample No.	Sample Depth (ft.-in.)	Visual Description & Unified Soil Classification (ASTM D-2488)		Percent Passing Sieve							
					#4	#10	#20	#40	#60	#80	#100	#200
10A-CHAPEL-9	J-1	0-2.3	Brown calcareous clay with sand	CH	94.1	85.6	78.7	75.3	73.4	72.2	71.8	70.0
	J-2	2.3-4	Tan calcareous clay with sand	CL	90.5	83.7	80.4	78.7	77.7	76.9	76.5	75.0
	J-3	4-8.3	Tan calcareous clay	CH	98.8	95.6	94.2	93.5	92.9	92.4	92.1	90.6
10A-CHAPEL-10	J-1	0-1.8	Light brown clay	CH	--	--	--	--	--	--	--	--
	J-2	1.8-4.3	Tan calcareous clay	CH	--	--	--	--	--	--	--	--
	J-3	4.3-7.2	Tan calcareous clay	CL	--	--	--	--	--	--	--	--
	J-4	7.2-10	Tan calcareous clay	CL	--	--	--	--	--	--	--	--
10A-CHAPEL-11	J-1	0-3.2	Brown clay	CH	97.2	96.0	94.8	94.1	93.7	93.2	93.0	91.6
	J-2	3.2-6	Tan calcareous clay with limestone fragments	CH	84.9	82.4	80.6	79.8	79.1	78.4	78.0	76.7
	J-3	6-8.9	Tan calcareous clay	CL	95.5	91.9	89.6	88.5	87.7	87.1	86.8	85.1
10A-CHAPEL-12	J-1	0-2.3	Brown clay	CH	98.3	95.2	92.5	90.9	89.9	89.1	88.8	87.5
	J-2	2.3-6.7	Tan calcareous clay with limestone fragments	CH	91.1	88.9	87.6	87.0	86.5	86.1	85.8	84.2
	J-3	6.7-10	Tan calcareous clay	CH	96.1	93.1	92.0	91.5	91.0	90.5	90.2	89.0
10A-CHAPEL-13	J-1	0-.9	Brown clay with sand	CH	97.9	93.8	89.0	85.3	82.6	80.4	79.5	75.6
	J-2	.9-4.2	Light brown sandy clay with limestone fragments	CL	95.3	86.8	78.9	73.4	69.8	67.5	67.0	64.5
	J-3	4.2-8.7	Tan calcareous clay with limestone fragments	CL	94.8	91.9	89.5	88.0	87.2	86.5	86.2	84.4
10A-CHAPEL-14	J-1	.54-3.9	Brown clayey gravel with sand and limestone fragments	CL	65.4	54.8	50.7	48.6	47.2	46.1	45.5	42.0
	J-2	3.9-6.1	Tan clayey gravel with sand and limestone fragments	CL	81.7	61.3	50.6	46.3	44.0	42.5	41.9	39.4
	J-3	6.1-10	Tan calcareous clay	CL	99.6	96.9	93.8	92.0	91.1	90.3	90.0	88.1

**SUMMARY OF LABORATORY TEST RESULTS**  
**LABORATORY TESTING SERVICES**  
**CHAPEL AND RELIGIOUS EDUCATION FACILITY**  
**FORT HOOD, TEXAS**

Boring No.	Sample No.	Sample Depth (ft.)	Visual Description & Unified Soil Classification (ASTM D-2488)		Moisture Content (%)	Unit Dry Weight (pcf)	Atterberg Limits			Consolidation Test
							LL	PL	PI	
8A4C-CHAPEL-1	J-1	0-2.1	Brown clay	CH	14.5	--	76	26	50	
	J-2	3.4-5.9	Tan clay with sand	CL	4.9	--	37	17	20	
	J-3	5.9-7.4	Tan clay	CH	14.8	--	59	18	41	
	J-4	12.3-15.1	Tan and light brown clay	CH	11.0	--	51	19	32	
	C-1	17.2-17.9	Tan and gray weathered limestone	N/A	10.7	130.4	--	--	--	
	C-2	23.7-24.5	Light gray limestone	N/A	12.4	123.9	--	--	--	
	C-3	29.2-30	Gray limestone	N/A	10.1	131.1	--	--	--	
	C-4	30-30.8	Gray limestone	N/A	8.1	138.7	--	--	--	
	C-5	39.3-40	Gray limestone	N/A	8.6	135.0	--	--	--	
	C-6	42.5-43.2	Light gray limestone	N/A	12.9	124.5	--	--	--	
8A4C-CHAPEL-2	J-1	0-3.9	Light brown clay	CH	11.6	--	72	25	47	
	J-2	5-7	Tan and light brown clay	CL	14.9	--	31	16	15	
	J-3	11.7-13	Tan and light gray clay	CL	8.9	--	35	16	19	
	C-1	18.1-18.7	Tan weathered limestone	N/A	12.0	125.2	--	--	--	
	C-2	23.6-24.3	Tan weathered limestone	N/A	10.2	130.1	--	--	--	
	C-3	26.7-27.4	Gray limestone	N/A	8.7	135.5	--	--	--	
	C-4	32.3-33.1	Gray limestone	N/A	8.3	135.9	--	--	--	
	C-5	38.2-38.7	Light gray limestone	N/A	8.4	135.5	--	--	--	
8A4C-CHAPEL-3	ST-1	0-1	Grayish brown clay with sand	CH	16.5	99.0	53	21	32	*
	J-1	1-3.5	Tan sandy clay with calcareous nodules	CL	4.1	--	32	19	13	
	J-2	5-6.5	Tan sandy clay	CL	14.9	--	47	17	30	
	J-3	9-10	Light brown clay	CH	18.7	--	62	17	45	
	J-4	13.5-15	Light brown clay	CH	16.1	--	59	20	39	
	J-5	18.5-20	Tan and light gray limestone fragments	N/A	10.0	--	--	--	--	
	C-1	24.2-24.8	Tan and gray weathered limestone	N/A	7.0	140.3	--	--	--	
	C-2	28-28.8	Gray limestone	N/A	11.0	127.9	--	--	--	
	C-3	33.6-34.4	Gray limestone	N/A	9.9	130.9	--	--	--	
	C-4	39.2-40	Gray limestone	N/A	8.8	137.0	--	--	--	
	C-5	43.5-44.2	Gray limestone	N/A	8.3	137.6	--	--	--	

\* See attached "Laboratory Test Data Sheets" for Consolidation Test Results

**SUMMARY OF LABORATORY TEST RESULTS**  
**LABORATORY TESTING SERVICES**  
**CHAPEL AND RELIGIOUS EDUCATION FACILITY**  
**FORT HOOD, TEXAS**

Boring No.	Sample No.	Sample Depth (ft.)	Visual Description & Unified Soil Classification (ASTM D-2488)		Moisture Content (%)	Unit Dry Weight (pcf)	Atterberg Limits			Consolidation Test
							LL	PL	PI	
8A4C-CHAPEL-4	J-1	0-8	Light brown sandy clay	CH	12.0	--	58	23	35	
	J-2	2-3.5	Light tan calcareous clay with sand	CL	6.5	--	42	19	23	
	J-3	5-7.5	Light tan calcareous clay	CH	17.3	--	64	21	43	
	J-4	11.5-13	Tan silty clay	CL	8.2	--	35	15	20	
	C-1	16.5-17	Tan fossiliferous limestone with clay/shale inclusions	N/A	6.4	138.1	Non-Plastic			
	C-2	23.6-24.3	Light gray limestone	N/A	11.5	127.2	--	--	--	
	C-3	26.5-27.4	Light gray limestone	N/A	10.6	130.7	--	--	--	
	C-4	30.7-31.5	Gray limestone	N/A	7.9	138.9	--	--	--	
	C-5	39.2-10	Light gray limestone	N/A	10.6	129.5	--	--	--	
	C-6	40.4-41.2	Light gray limestone	N/A	9.0	133.8	--	--	--	
8A4C-CHAPEL-5	J-1	2-3	Brown clay	CH	17.5	--	84	24	60	
	J-2	5-6	Tan calcareous clay with sand	CL	14.6	--	36	16	20	
	J-3	9-10	Tan calcareous clay with sand	CL	7.9	--	33	16	17	
	J-4	11-12	Tan calcareous clay with limestone fragments	CL	10.6	--	32	16	16	
	C-1	18.6-19.4	Tan weathered limestone	N/A	11.9	127.2	--	--	--	
	C-2	21.9-22.7	Gray limestone	N/A	10.5	131.4	--	--	--	
	C-3	27.9-28.5	Gray fossiliferous limestone	N/A	9.6	135.3	--	--	--	
	C-4	33.7-34.5	Light gray limestone	N/A	11.7	126.6	--	--	--	
	C-5	37.8-38.4	Light gray limestone	N/A	9.6	133.0	--	--	--	
	C-6	43-43.8	Gray limestone	N/A	9.6	134.5	--	--	--	
10A-CHAPEL-6	J-1	0-6.2	Brown clay	CH	23.6	--	95	25	70	
	J-2	6.2-7.9	Tan sandy clay with limestone fragments	CH	20.4	--	71	22	49	
	J-3	7.9-10	Tan calcareous clay	CL	7.7	--	41	16	25	
10A-CHAPEL-7	J-1	.32-2.7	Light brown clay with sand	CH	4.5	--	--	--	--	
	J-2	4.8-6.3	Tan calcareous clay	CL	14.3	--	--	--	--	
10A-CHAPEL-8	J-1	.25-3.8	Light brown sandy clay with gravel	CL	6.1	--	44	15	29	
	J-2	3.8-6.6	Light brown clay	CL	11.8	--	42	17	25	
	J-3	7.3-8	Tan calcareous clay with sand	CL	7.2	--	35	15	20	

**SUMMARY OF LABORATORY TEST RESULTS**  
**LABORATORY TESTING SERVICES**  
**CHAPEL AND RELIGIOUS EDUCATION FACILITY**  
**FORT HOOD, TEXAS**

Boring No.	Sample No.	Sample Depth (ft.)	Visual Description & Unified Soil Classification (ASTM D-2488)	Moisture Content (%)	Unit Dry Weight (pcf)	Atterberg Limits			Consolidation Test
						LL	PL	PI	
10A-CHAPEL-9	J-1	0-2.3	Brown calcareous clay with sand	CH	6.9	--	51	24	27
	J-2	2.3-4	Tan calcareous clay with sand	CL	9.5	--	44	17	27
	J-3	4-8.3	Tan calcareous clay	CH	20.8	--	67	19	48
10A-CHAPEL-10	J-1	0-1.8	Light brown clay	CH	5.5	--	--	--	--
	J-2	1.8-4.3	Tan calcareous clay	CH	9.4	--	--	--	--
	J-3	4.3-7.2	Tan calcareous clay	CL	16.3	--	--	--	--
	J-4	7.2-10	Tan calcareous clay	CL	15.1	--	--	--	--
10A-CHAPEL-11	J-1	0-3.2	Brown clay	CH	24.9	--	93	28	65
	J-2	3.2-6	Tan calcareous clay with limestone fragments	CH	12.8	--	50	18	32
	J-3	6-8.9	Tan calcareous clay	CL	14.3	--	49	15	34
10A-CHAPEL-12	J-1	0-2.3	Brown clay	CH	17.7	--	80	28	52
	J-2	2.3-6.7	Tan calcareous clay with limestone fragments	CH	11.1	--	50	15	35
	J-3	6.7-10	Tan calcareous clay	CH	19.7	--	65	18	47
10A-CHAPEL-13	J-1	0-.9	Brown clay with sand	CH	15.1	--	69	23	46
	J-2	.9-4.2	Light brown sandy clay with limestone fragments	CL	10.0	--	36	20	16
	J-3	4.2-8.7	Tan calcareous clay with limestone fragments	CL	15.2	--	48	16	32
10A-CHAPEL-14	J-1	.54-3.9	Brown clayey gravel with sand and limestone fragments	CL	16.5	--	38	20	18
	J-2	3.9-6.1	Tan clayey gravel with sand and limestone fragments	CL	25.3	--	47	16	31
	J-3	6.1-10	Tan calcareous clay	CL	13.7	--	40	14	26

**SUMMARY OF LABORATORY TEST RESULTS**  
**LABORATORY TESTING SERVICES**  
**CHAPEL AND RELIGIOUS EDUCATION FACILITY**  
**FORT HOOD, TEXAS**

Boring No.	Sample No.	Sample Depth (ft.)	Visual Description & Unified Soil Classification (ASTM D-2488)	Moisture Content (%)	Unit Dry Weight (pcf)	Confining Pressure (tsf)	Q (tsf)	Strain @ Failure (%)	Type Failure
8A4C-CHAPEL-1	J-1	0-2.1	Brown clay	CH	14.5	--	--	--	
	J-2	3.4-5.9	Tan clay with sand	CL	4.9	--	--	--	
	J-3	5.9-7.4	Tan clay	CH	14.8	--	--	--	
	J-4	12.3-15.1	Tan and light brown clay	CH	11.0	--	--	--	
	C-1	17.2-17.9	Tan and gray weathered limestone	N/A	10.7	130.4	0.0	10.31	* Vertical
	C-2	23.7-24.5	Light gray limestone	N/A	12.4	123.9	0.0	63.4	* Vertical
	C-3	29.2-30	Gray limestone	N/A	10.1	131.1	0.0	74.0	* Vertical
	C-4	30-30.8	Gray limestone	N/A	8.1	138.7	0.0	49.3	* Vertical
	C-5	39.3-40	Gray limestone	N/A	8.6	135.0	0.0	62.8	* Vertical
	C-6	42.5-43.2	Light gray limestone	N/A	12.9	124.5	0.0	55.7	* Vertical
8A4C-CHAPEL-2	J-1	0-3.9	Light brown clay	CH	11.6	--	--	--	
	J-2	5-7	Tan and light brown clay	CL	14.9	--	--	--	
	J-3	11.7-13	Tan and light gray clay	CL	8.9	--	--	--	
	C-1	18.1-18.7	Tan weathered limestone	N/A	12.0	125.2	0.0	48.8	* Vertical
	C-2	23.6-24.3	Tan weathered limestone	N/A	10.2	130.1	0.0	24.8	* Vertical
	C-3	26.7-27.4	Gray limestone	N/A	8.7	135.5	0.0	36.4	* Vertical
	C-4	32.3-33.1	Gray limestone	N/A	8.3	135.9	0.0	62.8	* Vertical
	C-5	38.2-38.7	Light gray limestone	N/A	8.4	135.5	0.0	79.6	* Vertical
	C-6	41-41.7	Gray limestone	N/A	8.8	135.3	0.0	29.3	* Vertical
8A4C-CHAPEL-3	ST-1	0-1	Grayish brown clay with sand	CH	16.5	99.0	--	--	
	J-1	1-3.5	Tan sandy clay with calcareous nodules	CL	4.1	--	--	--	
	J-2	5-6.5	Tan sandy clay	CL	14.9	--	--	--	
	J-3	9-10	Light brown clay	CH	18.7	--	--	--	
	J-4	13.5-15	Light brown clay	CH	16.1	--	--	--	
	J-5	18.5-20	Tan and light gray limestone fragments	N/A	10.0	--	--	--	
	C-1	24.2-24.8	Tan and gray weathered limestone	N/A	7.0	140.3	0.0	33.9	* Vertical
	C-2	28-28.8	Gray limestone	N/A	11.0	127.9	0.0	100.7	* Vertical
	C-3	33.6-34.4	Gray limestone	N/A	9.9	130.9	0.0	118.8	* Vertical
	C-4	39.2-40	Gray limestone	N/A	8.8	137.0	0.0	34.5	* Vertical
	C-5	43.5-44.2	Gray limestone	N/A	8.3	137.6	0.0	24.9	* Vertical

\* Strain measurements were not recorded for this test. This sample was trimmed square, ends capped with high-strength gypsum, and tested in accordance with ASTM-2938 "Unconfined Compressive Strength of Intact Rock Core Specimens".

**SUMMARY OF LABORATORY TEST RESULTS**  
**LABORATORY TESTING SERVICES**  
**CHAPEL AND RELIGIOUS EDUCATION FACILITY**  
**FORT HOOD, TEXAS**

Boring No.	Sample No.	Sample Depth (ft.)	Visual Description & Unified Soil Classification (ASTM D-2488)		Moisture Content (%)	Unit Dry Weight (pcf)	Confining Pressure (tsf)	Q (tsf)	Strain @ Failure (%)	Type Failure
8A4C-CHAPEL-4	J-1	0-8	Light brown sandy clay	CH	12.0	--	--	--	--	
	J-2	2-3.5	Light tan calcareous clay with sand	CL	6.5	--	--	--	--	
	J-3	5-7.5	Light tan calcareous clay	CH	17.3	--	--	--	--	
	J-4	11.5-13	Tan silty clay	CL	8.2	--	--	--	--	
	C-1	16.5-17	Tan fossiliferous limestone with clay/shale inclusions	N/A	6.4	138.1	0.0	66.9	*	Vertical
	C-2	23.6-24.3	Light gray limestone	N/A	11.5	127.2	0.0	98.6	*	Vertical
	C-3	26.5-27.4	Light gray limestone	N/A	10.6	130.7	0.0	116.5	*	Vertical
	C-4	30.7-31.5	Gray limestone	N/A	7.9	138.9	0.0	62.1	*	Vertical
	C-5	39.2-10	Light gray limestone	N/A	10.6	129.5	0.0	93.1	*	Vertical
	C-6	40.4-41.2	Light gray limestone	N/A	9.0	133.8	0.0	126.5	*	Vertical
8A4C-CHAPEL-5	J-1	2-3	Brown clay	CH	17.5	--	--	--	--	
	J-2	5-6	Tan calcareous clay with sand	CL	14.6	--	--	--	--	
	J-3	9-10	Tan calcareous clay with sand	CL	7.9	--	--	--	--	
	J-4	11-12	Tan calcareous clay with limestone fragments	CL	10.6	--	--	--	--	
	C-1	18.6-19.4	Tan weathered limestone	N/A	11.9	127.2	0.0	104.9	*	Vertical
	C-2	21.9-22.7	Gray limestone	N/A	10.5	131.4	0.0	96.3	*	Vertical
	C-3	27.9-28.5	Gray fossiliferous limestone	N/A	9.6	135.3	0.0	19.51	*	Vertical
	C-4	33.7-34.5	Light gray limestone	N/A	11.7	126.6	0.0	112.2	*	Vertical
	C-5	37.8-38.4	Light gray limestone	N/A	9.6	133.0	0.0	58.6	*	Vertical
	C-6	43-43.8	Gray limestone	N/A	9.6	134.5	0.0	32.7	*	Vertical
10A-CHAPEL-6	J-1	0-6.2	Brown clay	CH	23.6	--	--	--	--	
	J-2	6.2-7.9	Tan sandy clay with limestone fragments	CH	20.4	--	--	--	--	
	J-3	7.9-10	Tan calcareous clay	CL	7.7	--	--	--	--	
10A-CHAPEL-7	J-1	.32-2.7	Light brown clay with sand	CH	4.5	--	--	--	--	
	J-2	4.8-6.3	Tan calcareous clay	CL	14.3	--	--	--	--	
10A-CHAPEL-8	J-1	.25-3.8	Light brown sandy clay with gravel	CL	6.1	--	--	--	--	
	J-2	3.8-6.6	Light brown clay	CL	11.8	--	--	--	--	
	J-3	7.3-8	Tan calcareous clay with sand	CL	7.2	--	--	--	--	

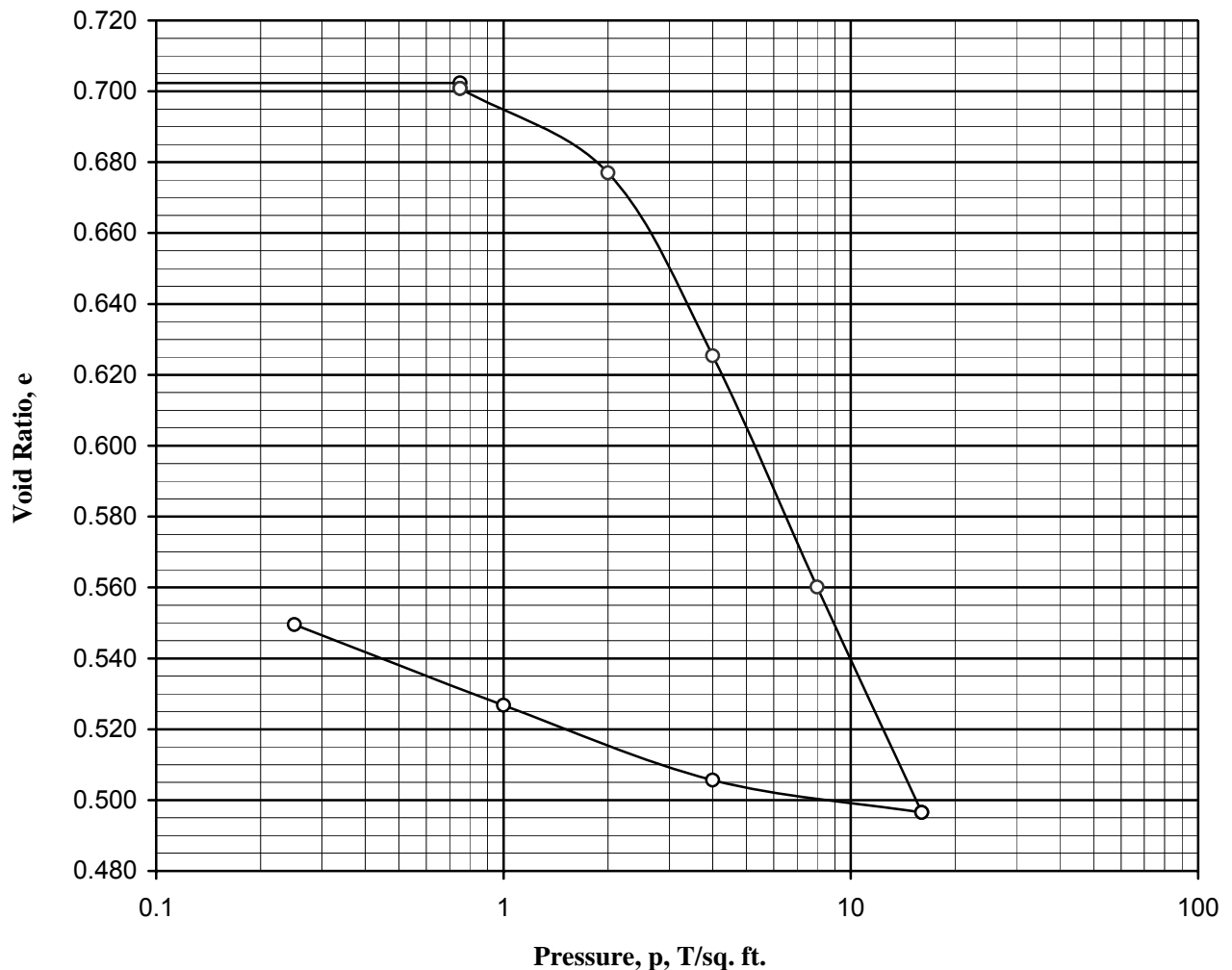
\* Strain measurements were not recorded for this test. This sample was trimmed square, ends capped with high-strength gypsum, and tested in accordance with ASTM-2938 "Unconfined Compressive Strength of Intact Rock Core Specimens".

**SUMMARY OF LABORATORY TEST RESULTS**  
**LABORATORY TESTING SERVICES**  
**CHAPEL AND RELIGIOUS EDUCATION FACILITY**  
**FORT HOOD, TEXAS**

Boring No.	Sample No.	Sample Depth (ft.)	Visual Description & Unified Soil Classification (ASTM D-2488)		Moisture Content (%)	Unit Dry Weight (pcf)	Confining Pressure (tsf)	Q (tsf)	Strain @ Failure (%)	Type Failure
10A-CHAPEL-9	J-1	0-2.3	Brown calcareous clay with sand	CH	6.9	--	--	--	--	
	J-2	2.3-4	Tan calcareous clay with sand	CL	9.5	--	--	--	--	
	J-3	4-8.3	Tan calcareous clay	CH	20.8	--	--	--	--	
10A-CHAPEL-10	J-1	0-1.8	Light brown clay	CH	5.5	--	--	--	--	
	J-2	1.8-4.3	Tan calcareous clay	CH	9.4	--	--	--	--	
	J-3	4.3-7.2	Tan calcareous clay	CL	16.3	--	--	--	--	
	J-4	7.2-10	Tan calcareous clay	CL	15.1	--	--	--	--	
10A-CHAPEL-11	J-1	0-3.2	Brown clay	CH	24.9	--	--	--	--	
	J-2	3.2-6	Tan calcareous clay with limestone fragments	CH	12.8	--	--	--	--	
	J-3	6-8.9	Tan calcareous clay	CL	14.3	--	--	--	--	
10A-CHAPEL-12	J-1	0-2.3	Brown clay	CH	17.7	--	--	--	--	
	J-2	2.3-6.7	Tan calcareous clay with limestone fragments	CH	11.1	--	--	--	--	
	J-3	6.7-10	Tan calcareous clay	CH	19.7	--	--	--	--	
10A-CHAPEL-13	J-1	0-.9	Brown clay with sand	CH	15.1	--	--	--	--	
	J-2	.9-4.2	Light brown sandy clay with limestone fragments	CL	10.0	--	--	--	--	
	J-3	4.2-8.7	Tan calcareous clay with limestone fragments	CL	15.2	--	--	--	--	
10A-CHAPEL-14	J-1	.54-3.9	Brown clayey gravel with sand and limestone fragments	CL	16.5	--	--	--	--	
	J-2	3.9-6.1	Tan clayey gravel with sand and limestone fragments	CL	25.3	--	--	--	--	
	J-3	6.1-10	Tan calcareous clay	CL	13.7	--	--	--	--	

# TEAM Consultants, Inc.

## Geotechnical, Environmental, Construction Materials Testing



Type of specimen:		Undisturbed	Before Test		After Test			
Diam.	2.50 in.	Ht.	0.450 in.	Water Content, $w_o$	16.52%	$W_f$	20.00%	
Overburden Pressure, $P_o$				T/sq. ft.	Void Ratio, $e_o$	0.7023	$e_f$	0.5495
Preconsol. Pressure, $P_c$				T/sq. ft.	Saturation, $S_o$	63.5%	$S_f$	98.2%
Compression Index, $C_c$				Dry Density, $\gamma_d$	99.0 lb/ft <sup>3</sup>			
Classification Grayish brown clay with sand								
LL	53	$G_s$	2.700 (assumed)	Project Chapel and Religious Education Facility, Fort Hood  Team Project No.: 092021  Boring No: 8A4C-03 Sample No.: ST-1  Depth: 0-1 Date: 2/6/09  <b>CONSOLIDATION TEST REPORT</b>				
PL	21							
Remarks								

Friday, June 18, 2010



**SUMMARY OF LABORATORY TEST RESULTS**  
**LABORATORY TESTING SERVICES**  
**CHILD DEVELOPMENT CENTER (TANK BATTALION AVENUE)**  
**FORT HOOD, TEXAS**

Boring No.	Sample No.	Sample Depth (ft.-in.)	Visual Description & Unified Soil Classification (ASTM D-2488)		Percent Passing Sieve							
					#4	#10	#20	#40	#60	#80	#100	#200
8A4C-CDC(FY10)-1	ST-1	0-2	Dark brown clay	CH	98.3	96.6	94.3	91.7	90.0	88.7	88.4	86.9
	ST-3	13-15	Brown and tan calcareous clay	CL	---	---	---	---	---	---	---	---
	C-1	33-33'8"	Gray limestone with dark gray shale lenses	N/A	---	---	---	---	---	---	---	---
8A4C-CDC(FY10)-2	C-1	23-24	Light gray and tan weathered limestone	N/A	---	---	---	---	---	---	---	---
	C-2	27-28	Gray and tan weathered limestone	N/A	---	---	---	---	---	---	---	---
	C-3	30-33	Gray limestone with dark gray shale lenses	N/A	---	---	---	---	---	---	---	---
	C-4	33-35	Gray limestone with dark gray shale lenses	N/A	---	---	---	---	---	---	---	---
	C-5	35-36	Gray limestone with dark gray shale lenses	N/A	---	---	---	---	---	---	---	---
	C-8	42-43	Gray limestone with dark gray shale lenses	N/A	---	---	---	---	---	---	---	---
8A4C-CDC(FY10)-3	C-2	38-39	Gray limestone with dark gray shale lenses	N/A	---	---	---	---	---	---	---	---
8A4C-CDC(FY10)-4	ST-1	0-2	Dark brown clay	CH	98.2	96.0	93.1	91.5	90.4	89.7	89.5	88.6
	ST-2	5-7	Brown and tan calcareous clay	CL	---	---	---	---	---	---	---	---
	ST-3	10-12	Tan and gray silty clay	CH	---	---	---	---	---	---	---	---
	ST-4	15-17	Tan and gray silty clay	CL	---	---	---	---	---	---	---	---
	J-1	20-21	Tan and gray weathered limestone	N/A	---	---	---	---	---	---	---	---
	J-2	25-26	Tan and gray weathered limestone	N/A	---	---	---	---	---	---	---	---
	J-3	30-31	Gray weathered limestone	N/A	---	---	---	---	---	---	---	---
	C-1	33-34	Gray weathered limestone	N/A	---	---	---	---	---	---	---	---
	C-3	38-39	Gray fossiliferous limestone	N/A	---	---	---	---	---	---	---	---
	C-5	41'6"-42'3"	Gray limestone with dark gray shale lenses	N/A	---	---	---	---	---	---	---	---
8A4C-CDC(FY10)-5	C-1	33'9"-34'5"	Gray limestone	N/A	---	---	---	---	---	---	---	---
	C-3	39'5"-40	Gray limestone	N/A	---	---	---	---	---	---	---	---
	C-5	44-44'8"	Gray limestone with dark gray shale lenses	N/A	---	---	---	---	---	---	---	---
10A-CDC(FY10)-7	ST-1	3-5	Brown and tan calcareous clay with sand	CH	99.9	99.3	98.4	96.0	91.7	89.0	88.1	84.7
	ST-2	8-10	Brown and tan calcareous clay	CH	94.4	92.8	92.2	91.8	91.2	90.7	90.6	89.8
10A-CDC(FY10)-11	ST-1	3-5	Brown and tan calcareous clay with sand	CL	94.0	91.4	88.9	97.6	96.4	86.0	85.7	84.8
	ST-2	8-10	Brown and tan calcareous clay with sand	CH	88.0	85.0	83.0	82.0	80.0	79.0	79.0	77.0
10A-CDC(FY10)-13	ST-1	3-5	Dark brown clay	CH	98.6	95.2	92.9	91.8	91.0	90.7	90.5	89.8
	ST-2	8-10	Brown and tan calcareous clay with sand	CL	98.4	96.5	94.4	91.1	86.8	83.5	81.7	73.8

**SUMMARY OF LABORATORY TEST RESULTS**  
**LABORATORY TESTING SERVICES**  
**CHILD DEVELOPMENT CENTER (TANK BATTALION AVENUE)**  
**FORT HOOD, TEXAS**

Boring No.	Sample No.	Sample Depth (ft.)	Visual Description & Unified Soil Classification (ASTM D-2488)		Moisture Content (%)	Unit Dry Weight (pcf)	Atterberg Limits			Remarks
							LL	PL	PI	
8A4C-CDC(FY10)-1	ST-1	0-2	Dark brown clay	CH	23.1	102.8	87	27	60	
	ST-3	13-15	Brown and tan calcareous clay	CL	12.4	120.4	---	---	---	
	C-1	33-33'8"	Gray limestone with dark gray shale lenses	N/A	8.1	139.0	---	---	---	
8A4C-CDC(FY10)-2	C-1	23-24	Light gray and tan weathered limestone	N/A	13.5	122.3	---	---	---	
	C-2	27-28	Gray and tan weathered limestone	N/A	10.3	128.8	---	---	---	
	C-3	30-33	Gray limestone with dark gray shale lenses	N/A	8.8	135.7	---	---	---	
	C-4	33-35	Gray limestone with dark gray shale lenses	N/A	9.6	132.3	---	---	---	
	C-5	35-36	Gray limestone with dark gray shale lenses	N/A	8.1	137.9	---	---	---	
	C-8	42-43	Gray limestone with dark gray shale lenses	N/A	8.7	137.1	---	---	---	
8A4C-CDC(FY10)-3	C-2	38-39	Gray limestone with dark gray shale lenses	N/A	8.1	139.5	---	---	---	
8A4C-CDC(FY10)-4	ST-1	0-2	Dark brown clay	CH	19.7	102.9	77	26	51	
	ST-2	5-7	Brown and tan calcareous clay	CL	14.7	118.0	41	18	23	
	ST-3	10-12	Tan and gray silty clay	CH	13.6	123.3	54	23	31	
	ST-4	15-17	Tan and gray silty clay	CL	10.9	115.2	34	15	19	
	J-1	20-21	Tan and gray weathered limestone	N/A	1.9	---	---	---	---	*
	J-2	25-26	Tan and gray weathered limestone	N/A	15.5	---	---	---	---	*
	J-3	30-31	Gray weathered limestone	N/A	16.2	---	23	15	8	
	C-1	33-34	Gray weathered limestone	N/A	9.6	128.3	---	---	---	
	C-3	38-39	Gray fossiliferous limestone	N/A	9.0	135.6	---	---	---	
	C-5	41'6"-42'3"	Gray limestone with dark gray shale lenses	N/A	10.6	131.8	---	---	---	
8A4C-CDC(FY10)-5	C-1	33'9"-34'5"	Gray limestone	N/A	9.8	133.4	---	---	---	
	C-3	39'5"-40	Gray limestone	N/A	7.6	138.4	---	---	---	
	C-5	44-44'8"	Gray limestone with dark gray shale lenses	N/A	8.5	137.5	---	---	---	
10A-CDC(FY10)-7	ST-1	3-5	Brown and tan calcareous clay with sand	CH	19.0	---	51	18	33	
	ST-2	8-10	Brown and tan calcareous clay	CH	24.2	---	76	22	54	
10A-CDC(FY10)-11	ST-1	3-5	Brown and tan calcareous clay with sand	CL	10.6	---	35	17	18	
	ST-2	8-10	Brown and tan calcareous clay with sand	CH	18.0	---	63	19	44	
10A-CDC(FY10)-13	ST-1	3-5	Dark brown clay	CH	21.1	---	76	25	51	
	ST-2	8-10	Brown and tan calcareous clay with sand	CL	15.2	---	31	15	16	

\* Insufficient sample mass to perform Atterberg Limit test

**SUMMARY OF LABORATORY TEST RESULTS**
**LABORATORY TESTING SERVICES  
CHILD DEVELOPMENT CENTER (TANK BATTALION AVENUE)  
FORT HOOD, TEXAS**

Boring No.	Sample No.	Sample Depth (ft.)	Visual Description & Unified Soil Classification (ASTM D-2488)	Moisture Content (%)	Unit Dry Weight (pcf)	Confining Pressure (tsf)	Q (tsf)	Strain @ Failure (%)	Type Failure
8A4C-CDC(FY10)-1	ST-1	0-2	Dark brown clay	CH	23.1	102.8	---	---	---
	ST-3	13-15	Brown and tan calcareous clay	CL	12.4	120.4	---	---	---
	C-1	33-33'8"	Gray limestone with dark gray shale lenses	N/A	8.1	139.0	0	53.8	* Vertical
8A4C-CDC(FY10)-2	C-1	23-24	Light gray and tan weathered limestone	N/A	13.5	122.3	0	59.1	* Vertical
	C-2	27-28	Gray and tan weathered limestone	N/A	10.3	128.8	0	101.3	* Vertical
	C-3	30-33	Gray limestone with dark gray shale lenses	N/A	8.8	135.7	0	47.9	* Vertical
	C-4	33-35	Gray limestone with dark gray shale lenses	N/A	9.6	132.3	0	17.8	* Vertical
	C-5	35-36	Gray limestone with dark gray shale lenses	N/A	8.1	137.9	0	46.5	* Vertical
	C-8	42-43	Gray limestone with dark gray shale lenses	N/A	8.7	137.1	0	50.3	* Vertical
8A4C-CDC(FY10)-3	C-2	38-39	Gray limestone with dark gray shale lenses	N/A	8.1	139.5	0	44.3	* Vertical
8A4C-CDC(FY10)-4	ST-1	0-2	Dark brown clay	CH	19.7	102.9	---	---	---
	ST-2	5-7	Brown and tan calcareous clay	CL	14.7	118.0	---	---	---
	ST-3	10-12	Tan and gray silty clay	CH	13.6	123.3	---	---	---
	ST-4	15-17	Tan and gray silty clay	CL	10.9	115.2	---	---	---
	J-1	20-21	Tan and gray weathered limestone	N/A	1.9	---	---	---	---
	J-2	25-26	Tan and gray weathered limestone	N/A	15.5	---	---	---	---
	J-3	30-31	Gray weathered limestone	N/A	16.2	---	---	---	---
	C-1	33-34	Gray weathered limestone	N/A	9.6	128.3	0	55.7	* Vertical
	C-3	38-39	Gray fossiliferous limestone	N/A	9.0	135.6	0	36.0	* Vertical
	C-5	41'6"-42'3"	Gray limestone with dark gray shale lenses	N/A	10.6	131.8	0	11.4	* Vertical
8A4C-CDC(FY10)-5	C-1	33'9"-34'5"	Gray limestone	N/A	9.8	133.4	0	97.9	* Vertical
	C-3	39'5"-40	Gray limestone	N/A	7.6	138.4	0	100.8	* Vertical
	C-5	44-44'8"	Gray limestone with dark gray shale lenses	N/A	8.5	137.5	0	38.6	* Vertical
10A-CDC(FY10)-7	ST-1	3-5	Brown and tan calcareous clay with sand	CH	19.0	---	---	---	---
	ST-2	8-10	Brown and tan calcareous clay	CH	24.2	---	---	---	---
10A-CDC(FY10)-11	ST-1	3-5	Brown and tan calcareous clay with sand	CL	10.6	---	---	---	---
	ST-2	8-10	Brown and tan calcareous clay with sand	CH	18.0	---	---	---	---
10A-CDC(FY10)-13	ST-1	3-5	Dark brown clay	CH	21.1	---	---	---	---
	ST-2	8-10	Brown and tan calcareous clay with sand	CL	15.2	---	---	---	---

\* Strain measurements were not recorded for this test. This sample was trimmed square, ends capped with high-strength gypsum, and tested in accordance with ASTM-2938 "Unconfined Compressive Strength of Intact Rock Core Specimens".

## **APPENDIX D**

### **DYNAMIC CONE PENETROMETER (DCP) TESTING DATA PLOTS**

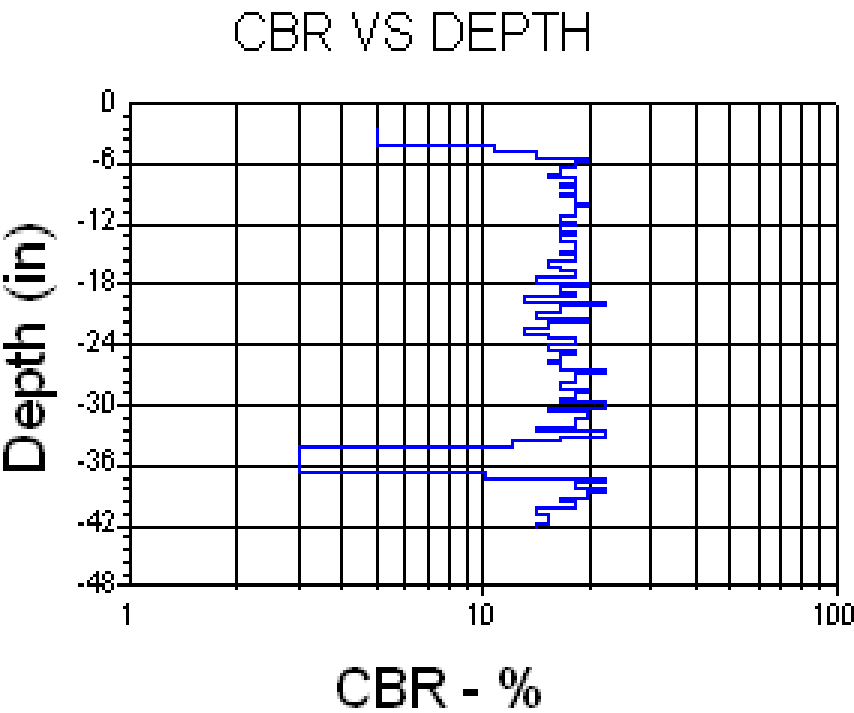
DCP TEST DATA

Project: Chapel and Religious Education Facility

Date: 28 January 2009

Feature: 10A-CHAPEL-6

Station: 10A-CHAPEL-6



(MM)	TEST PROFILE	(IN)
0	START DEPTH = 2.50"	0
127	SUBGRADE 3.50" CBR 13	5
254	UNASSIGNED 6.00" CBR 17	10
381	UNASSIGNED 6.00" CBR 17	15
508	UNASSIGNED 6.00" CBR 17	20
635		25
762		30
889	UNASSIGNED 18.50" CBR 17	35
1016		40
1143		45
1270		50

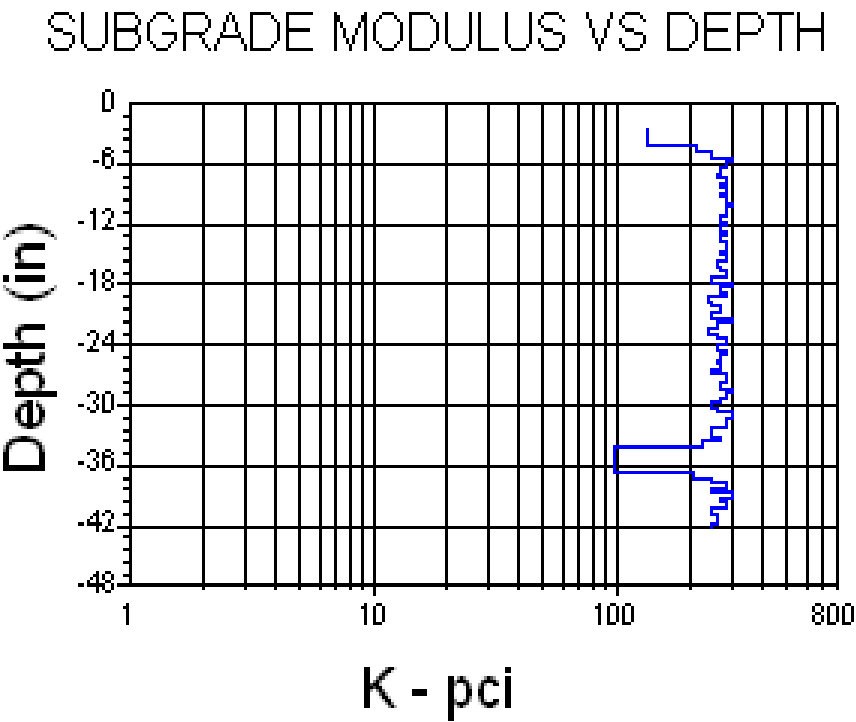
DCP TEST DATA

Project: Chapel and Religious Education Facility

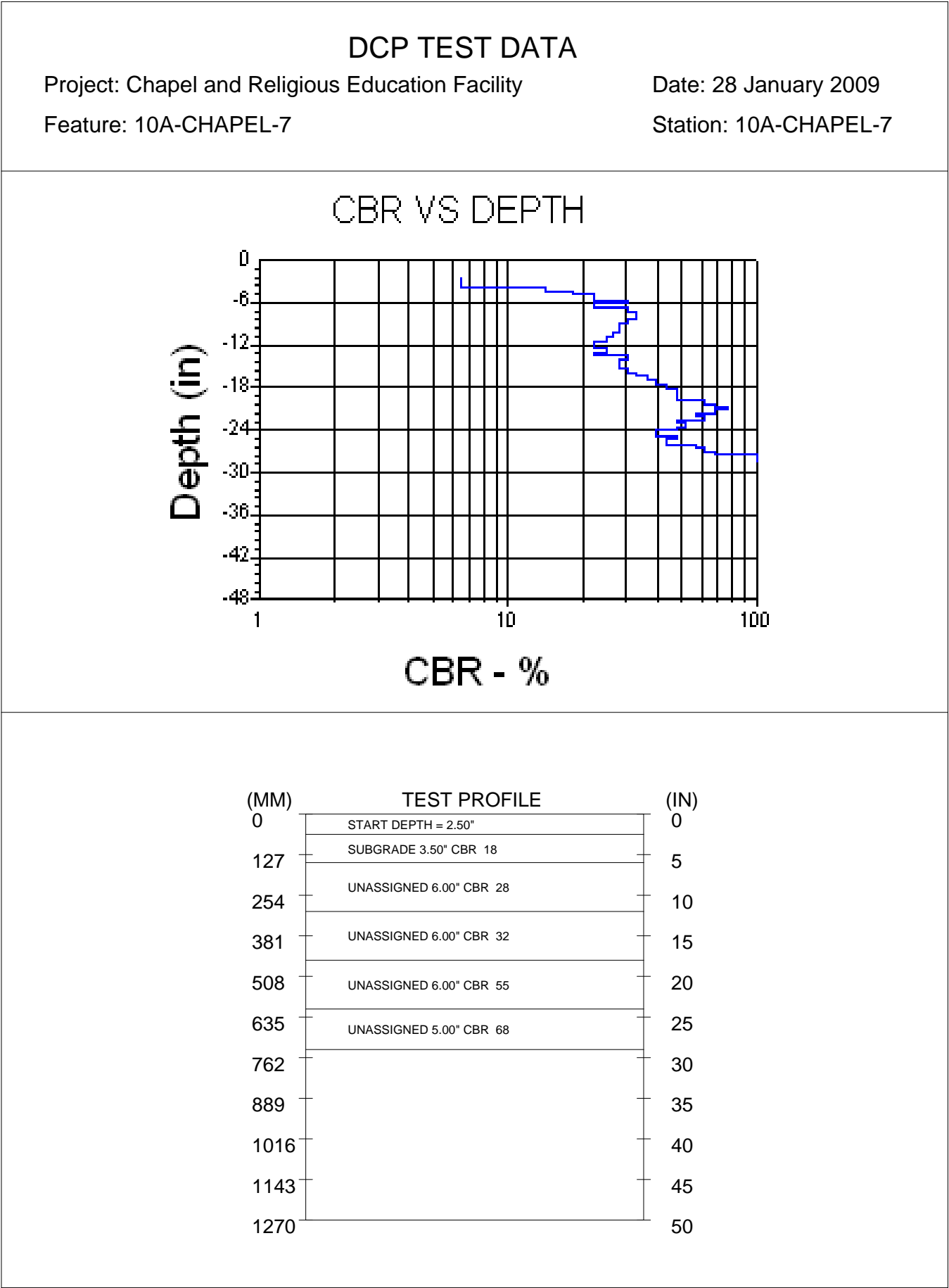
Date: 28 January 2009

Feature: 10A-CHAPEL-6

Station: 10A-CHAPEL-6



(MM)	TEST PROFILE	(IN)
0	START DEPTH = 2.50"	0
127	SUBGRADE 3.50" K 230	5
254	UNASSIGNED 6.00" K 279	10
381	UNASSIGNED 6.00" K 275	15
508	UNASSIGNED 6.00" K 264	20
635	UNASSIGNED 18.50" K 260	25
762		30
889		35
1016		40
1143		45
1270		50



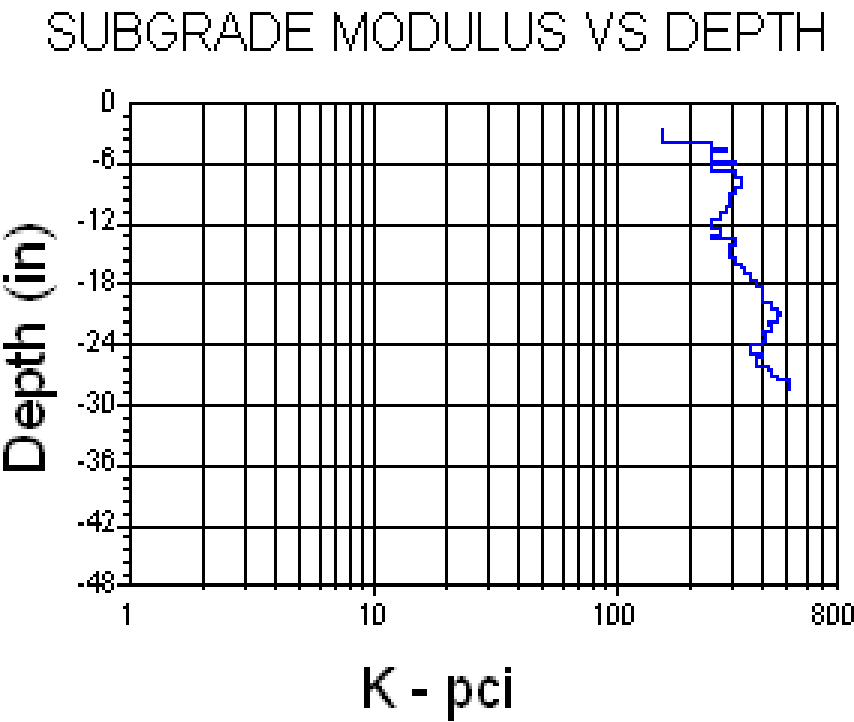
DCP TEST DATA

Project: Chapel and Religious Education Facility

Date: 28 January 2009

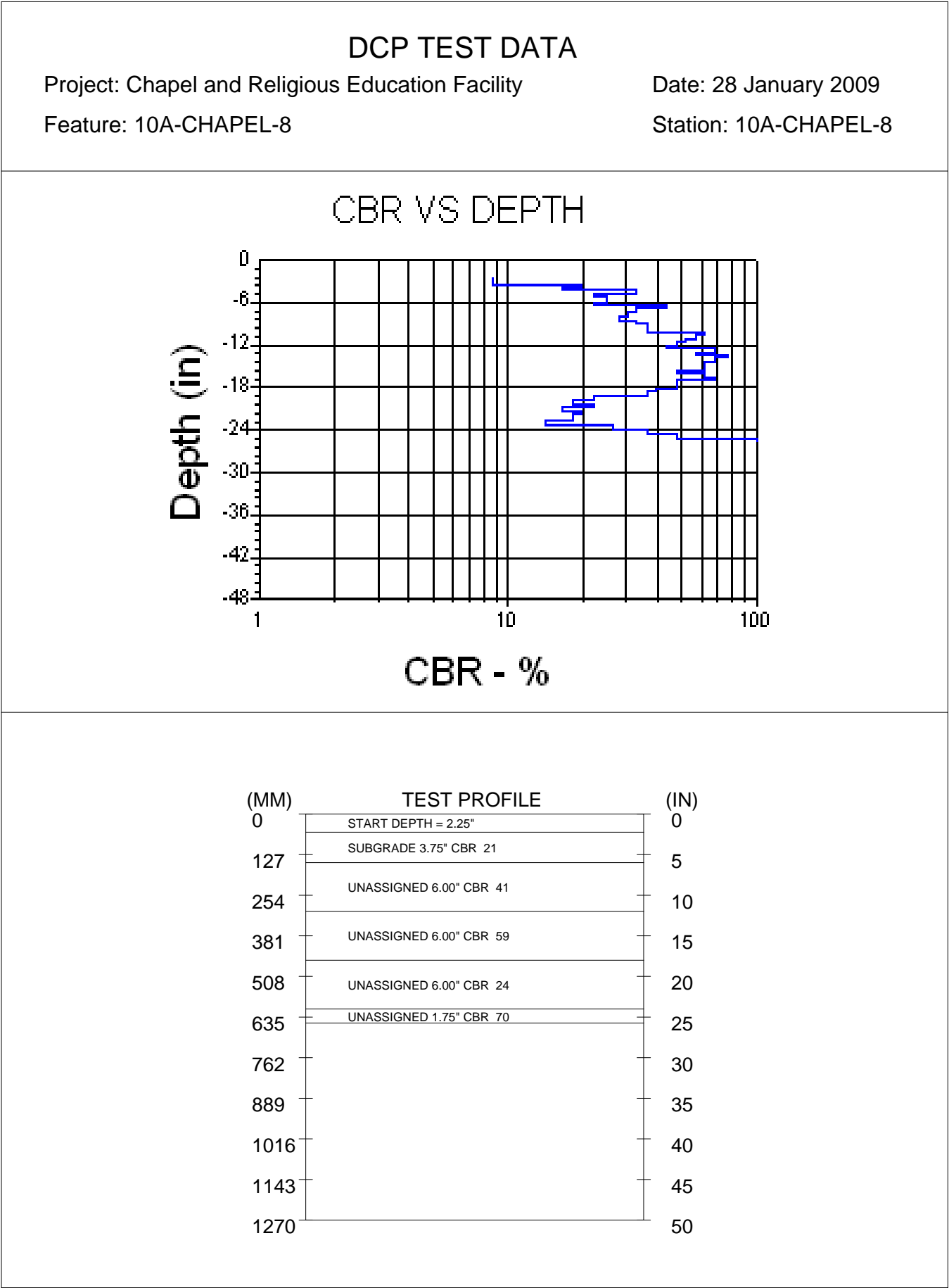
Feature: 10A-CHAPEL-7

Station: 10A-CHAPEL-7



(MM)	TEST PROFILE	(IN)
0	START DEPTH = 2.50"	0
127	SUBGRADE 3.50" K 242	5
254	UNASSIGNED 6.00" K 286	10
381	UNASSIGNED 6.00" K 309	15
508	UNASSIGNED 6.00" K 413	20
635	UNASSIGNED 5.00" K 434	25
762		30
889		35
1016		40
1143		45
1270		50





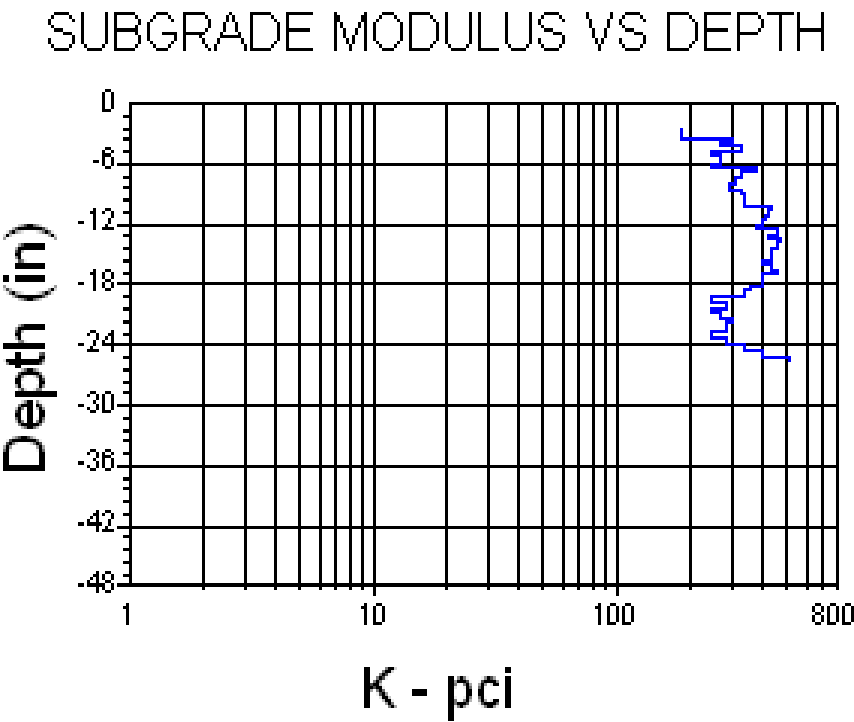
DCP TEST DATA

Project: Chapel and Religious Education Facility

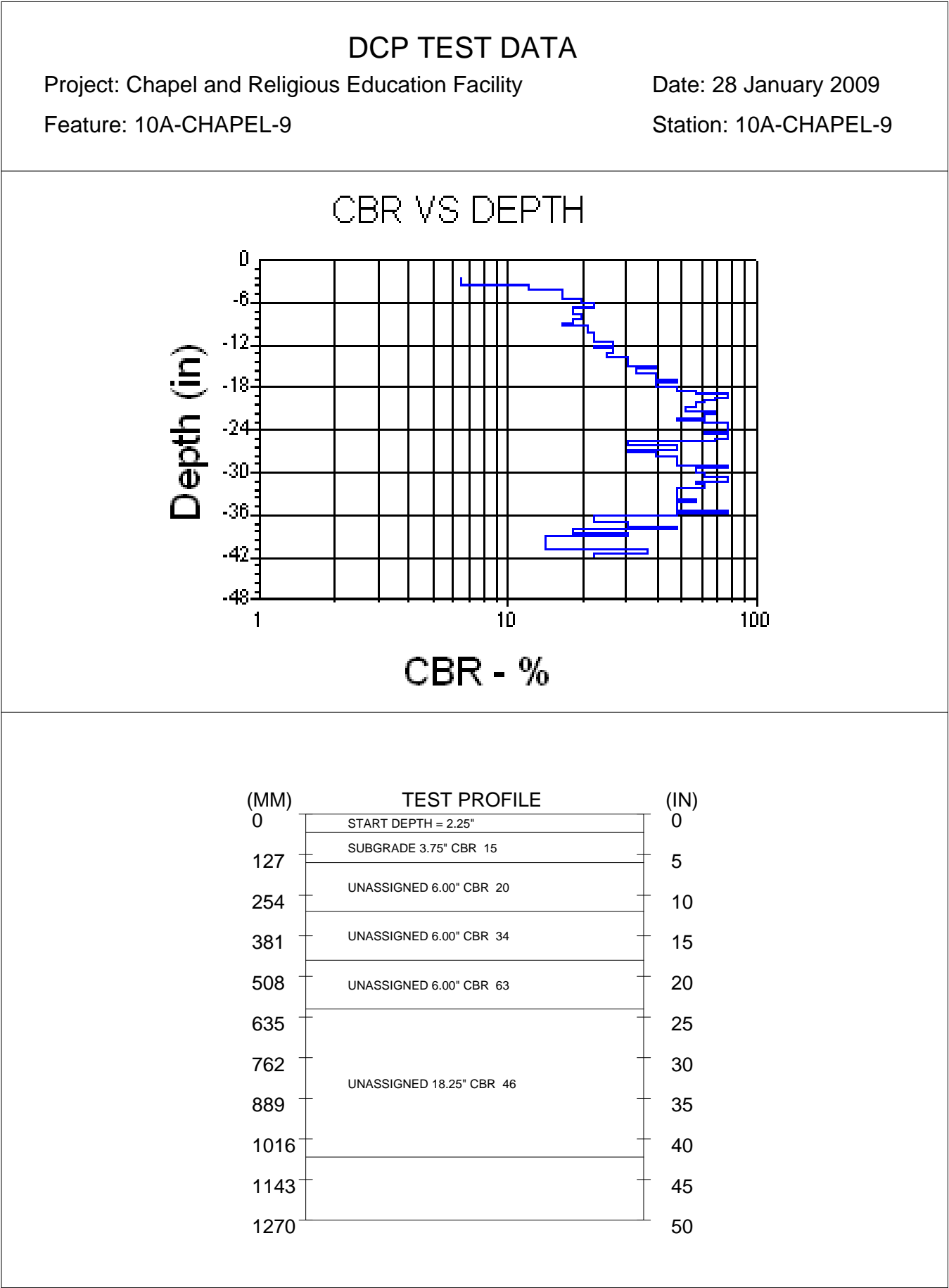
Date: 28 January 2009

Feature: 10A-CHAPEL-8

Station: 10A-CHAPEL-8



(MM)	TEST PROFILE	(IN)
0	START DEPTH = 2.25"	0
127	SUBGRADE 3.75" K 263	5
254	UNASSIGNED 6.00" K 351	10
381	UNASSIGNED 6.00" K 424	15
508	UNASSIGNED 6.00" K 288	20
635	UNASSIGNED 1.75" K 435	25
762		30
889		35
1016		40
1143		45
1270		50



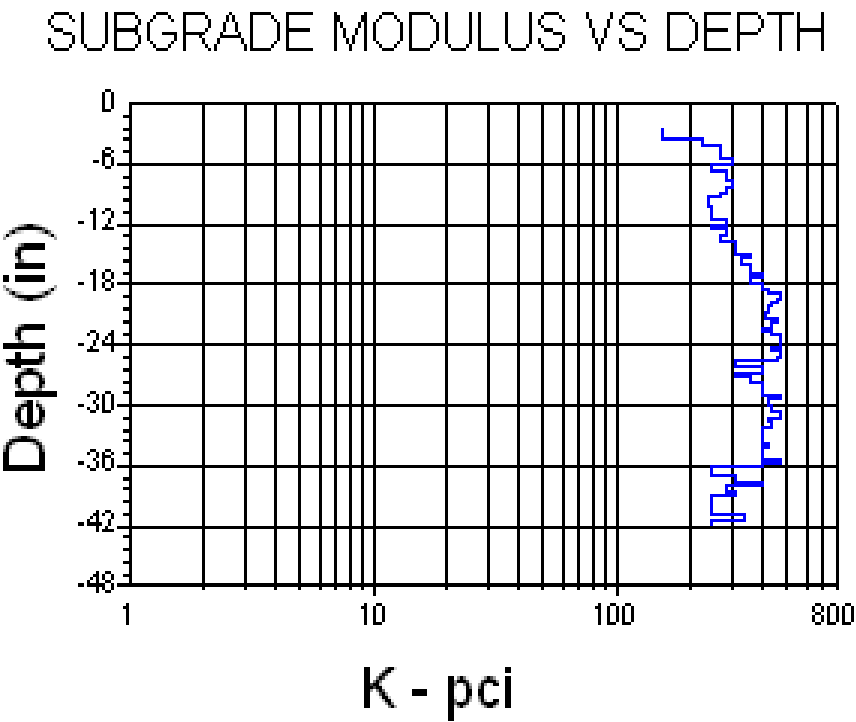
DCP TEST DATA

Project: Chapel and Religious Education Facility

Date: 28 January 2009

Feature: 10A-CHAPEL-9

Station: 10A-CHAPEL-9



(MM)	TEST PROFILE	(IN)
0	START DEPTH = 2.25"	0
127	SUBGRADE 3.75" K 250	5
254	UNASSIGNED 6.00" K 269	10
381	UNASSIGNED 6.00" K 322	15
508	UNASSIGNED 6.00" K 438	20
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762		30
889		35
1016		40
1143		45
1270		50

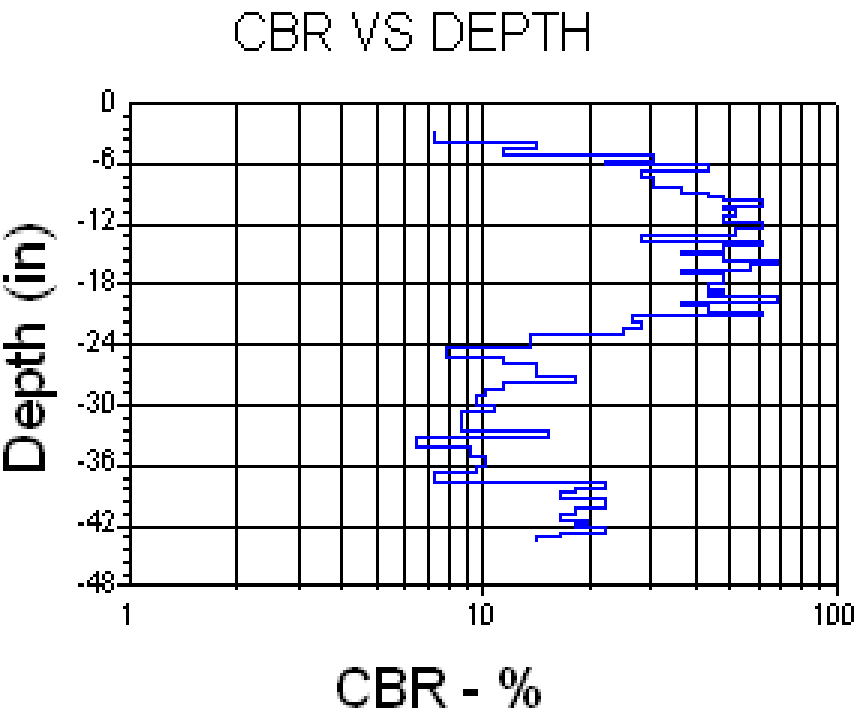
DCP TEST DATA

Project: Chapel and Religious Education Facility

Date: 28 January 2009

Feature: 10A-CHAPEL-13

Station: 10A-CHAPEL-13



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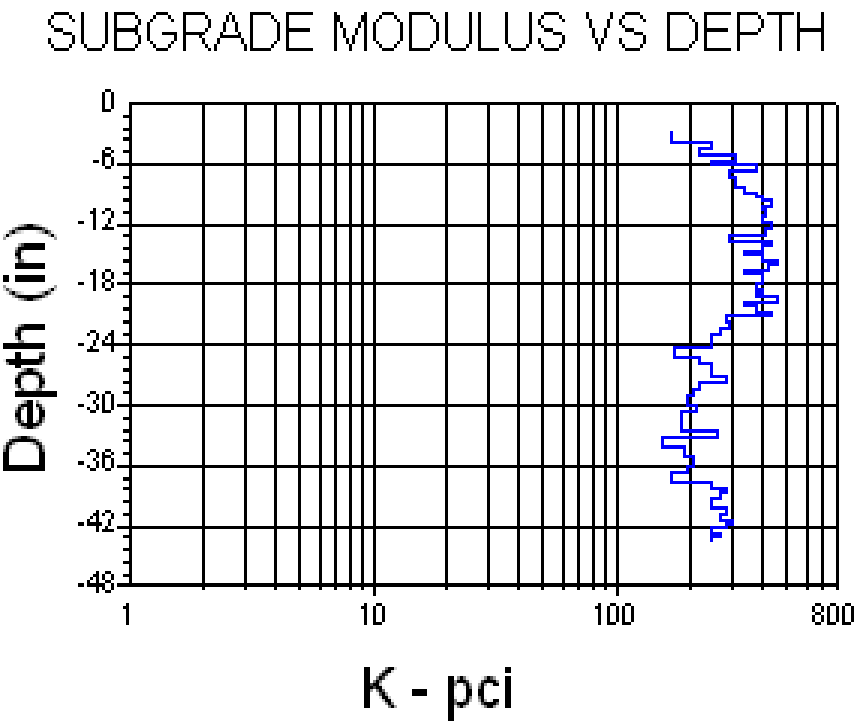
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Project: Chapel and Religious Education Facility

Date: 28 January 2009

Feature: 10A-CHAPEL-13

Station: 10A-CHAPEL-13

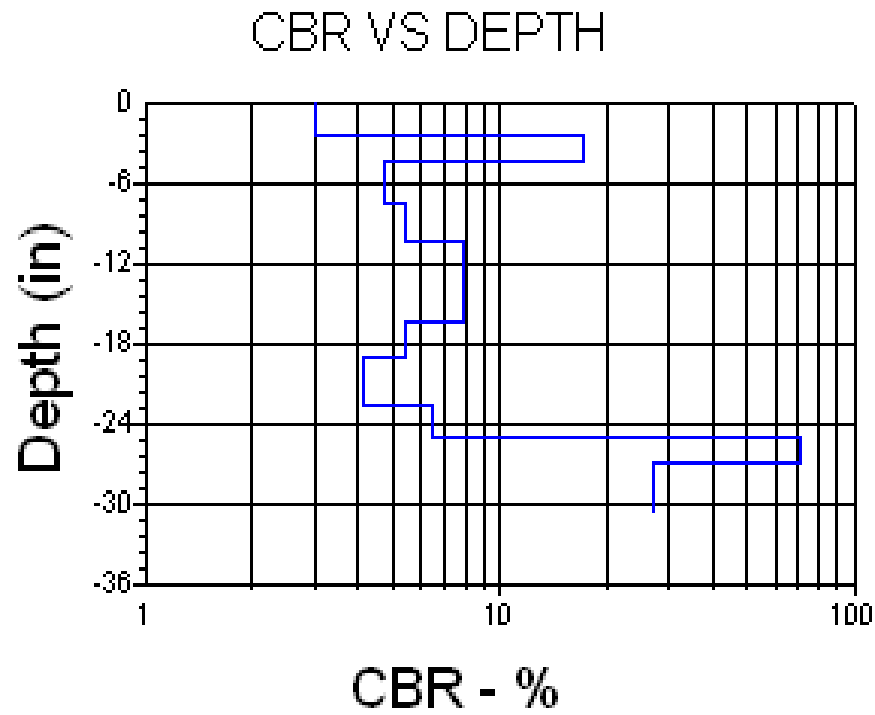


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762		30
889		35
1016		40
1143		45
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DCP TEST DATA

Project: Child Development Ctr (0-5YRS) -Tank Battalion AveDate: 7 January 2009

Feature: 10A-CDC(FY10)-6Station: 10A-CDC(FY10)-6

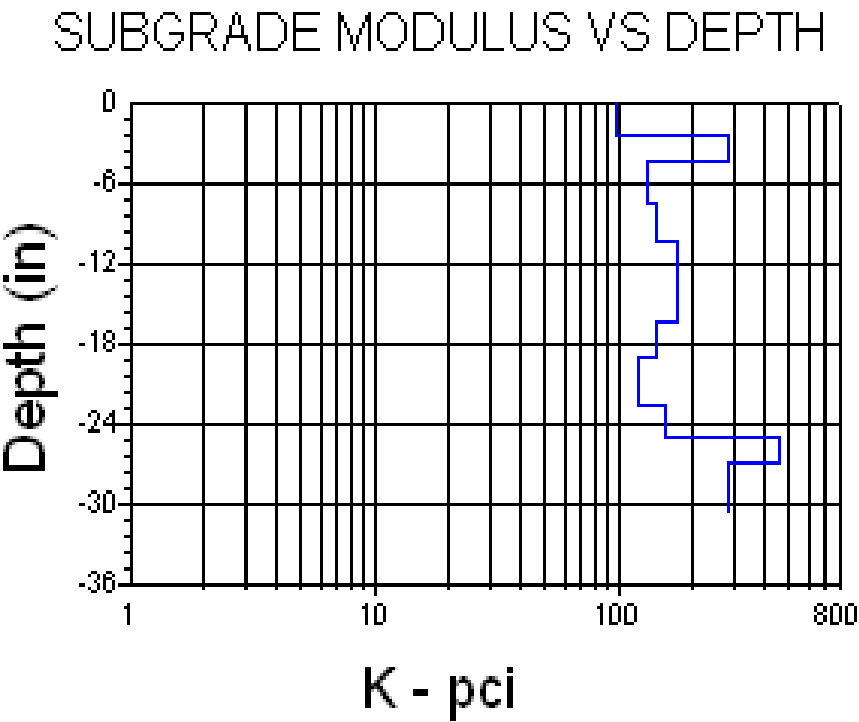


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1016		40
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DCP TEST DATA

Project: Child Development Ctr (0-5YRS) -Tank Battalion AveDate: 7 January 2009

Feature: 10A-CDC(FY10)-6Station: 10A-CDC(FY10)-6



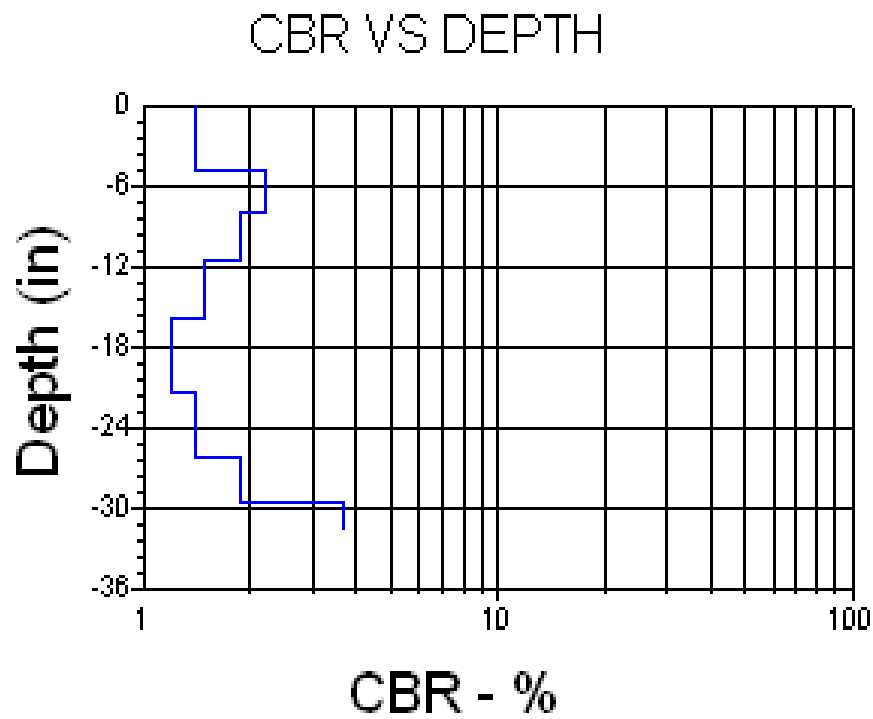
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DCP TEST DATA

Project: Child Development Ctr (0-5YRS) -Tank Battalion AveDate: 7 January 2009

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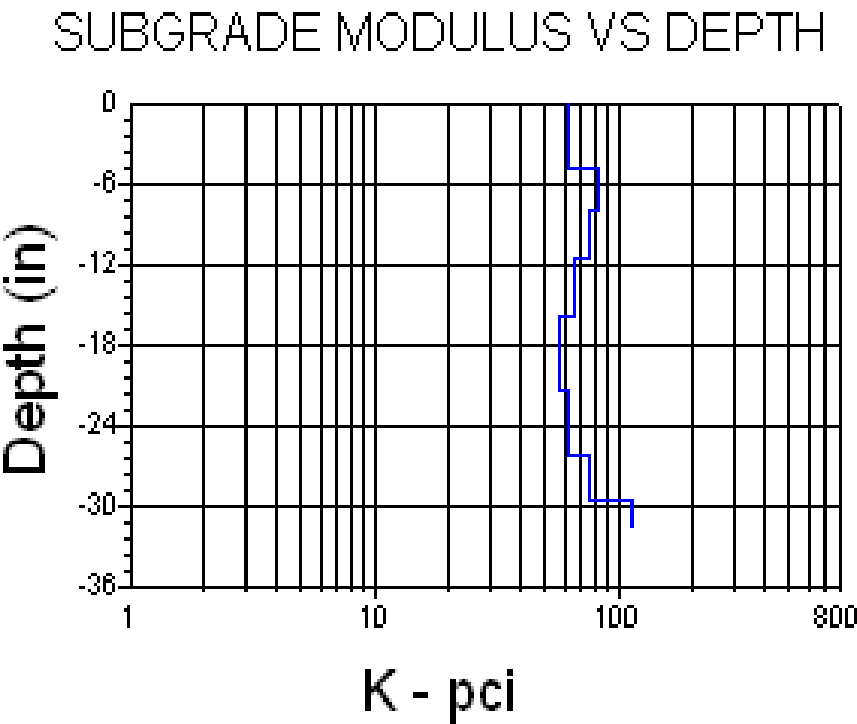


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1016		40
1143		45
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DCP TEST DATA

Project: Child Development Ctr (0-5YRS) -Tank Battalion AveDate: 7 January 2009

Feature: 10A-CDC(FY10)-7Station: 10A-CDC(FY10)-7

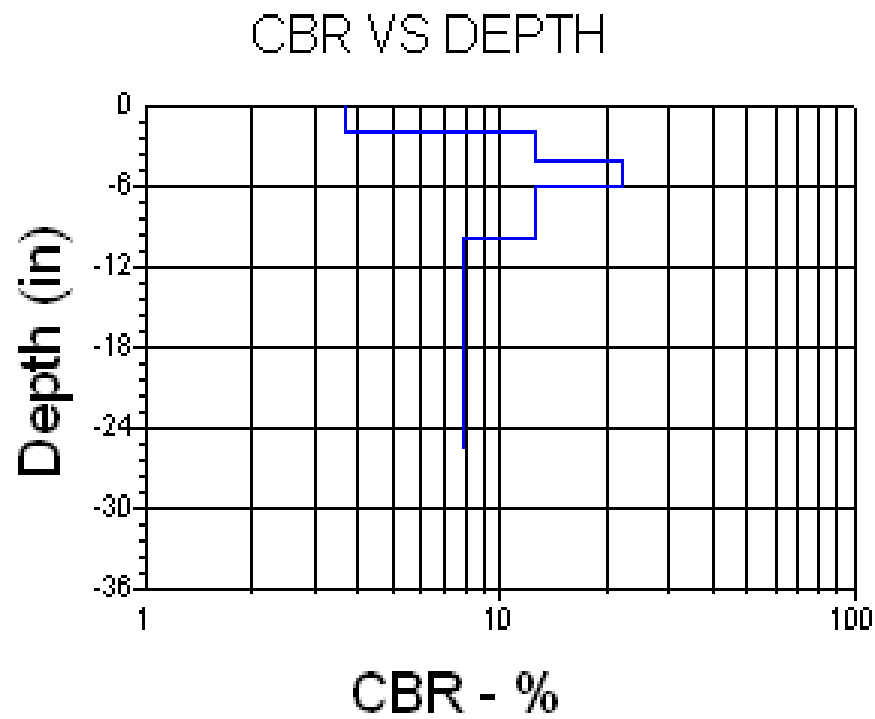


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762	UNASSIGNED 1.50" K 113	30
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DCP TEST DATA

Project: Child Development Ctr (0-5YRS) -Tank Battalion AveDate: 7 January 2009

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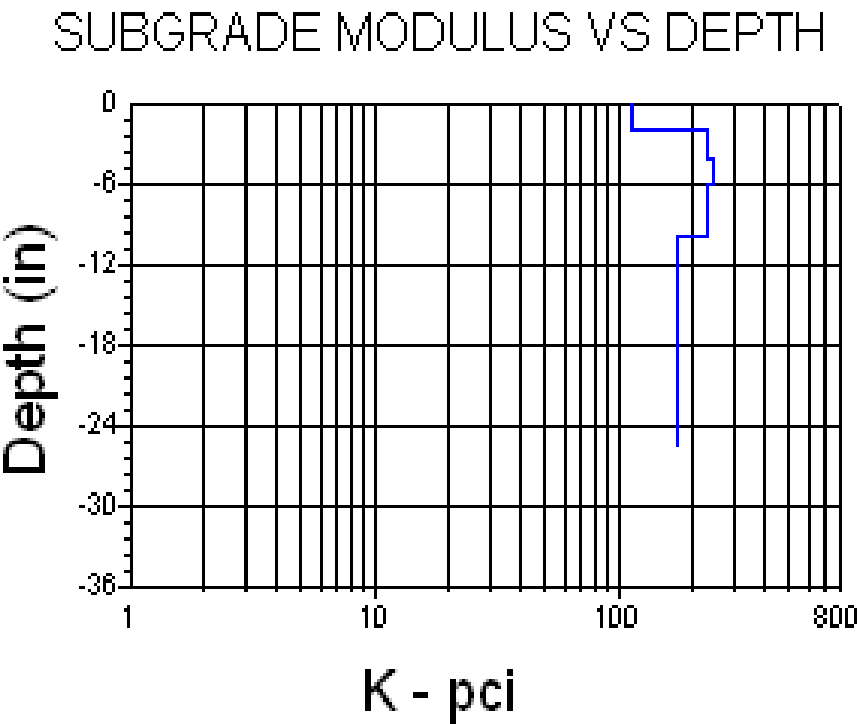


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635	UNASSIGNED 1.75" CBR 8	25
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889		35
1016		40
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DCP TEST DATA

Project: Child Development Ctr (0-5YRS) -Tank Battalion AveDate: 7 January 2009

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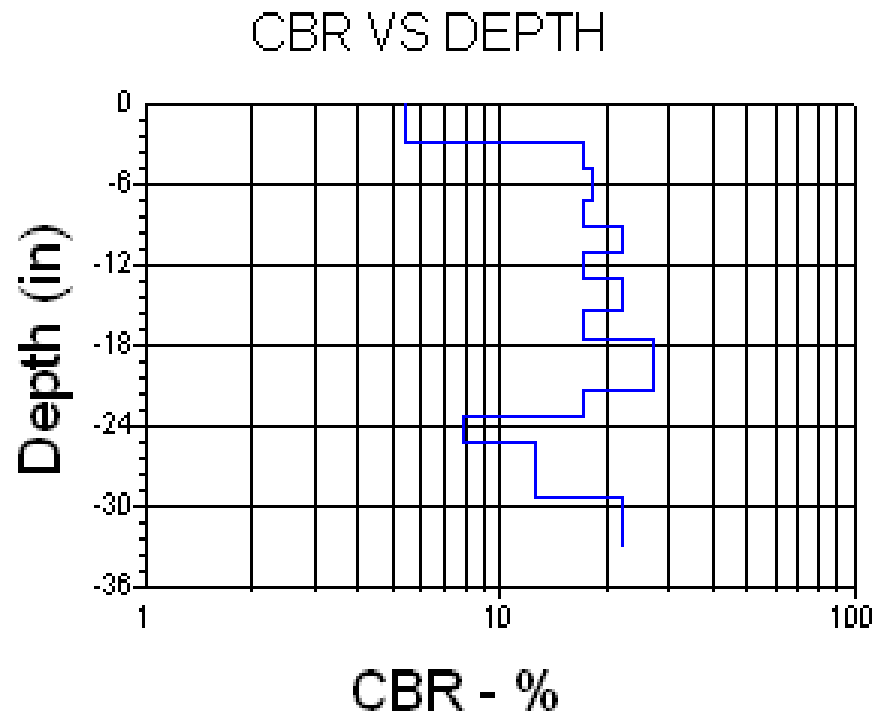


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635	UNASSIGNED 1.75" K 175	25
762		30
889		35
1016		40
1143		45
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DCP TEST DATA

Project: Child Development Ctr (0-5YRS) -Tank Battalion AveDate: 7 January 2009

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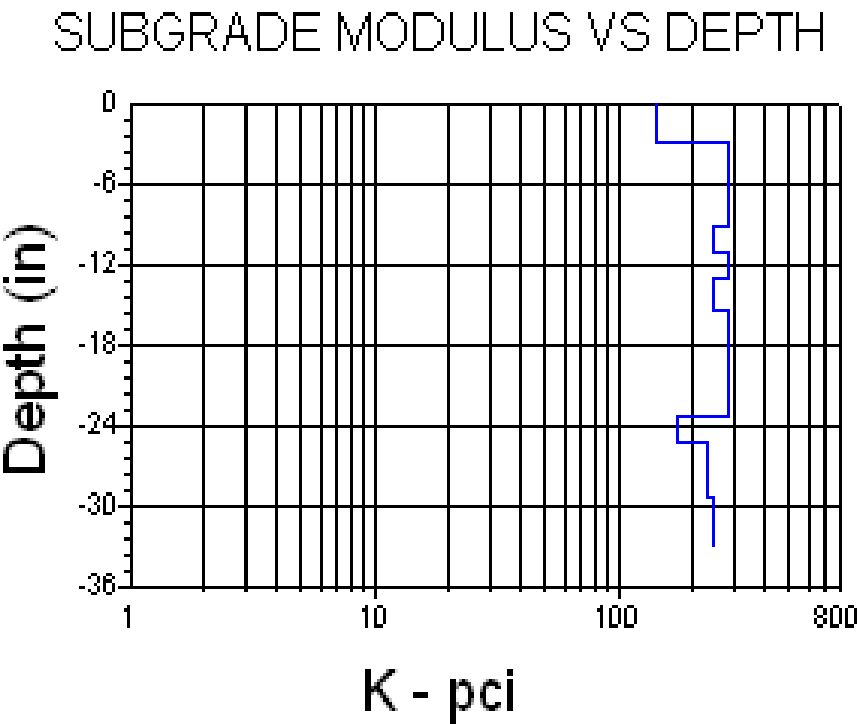


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762	UNASSIGNED 3.25" CBR 22	30
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1143		45
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DCP TEST DATA

Project: Child Development Ctr (0-5YRS) -Tank Battalion AveDate: 7 January 2009

Feature: 10A-CDC(FY10)-9Station: 10A-CDC(FY10)-9

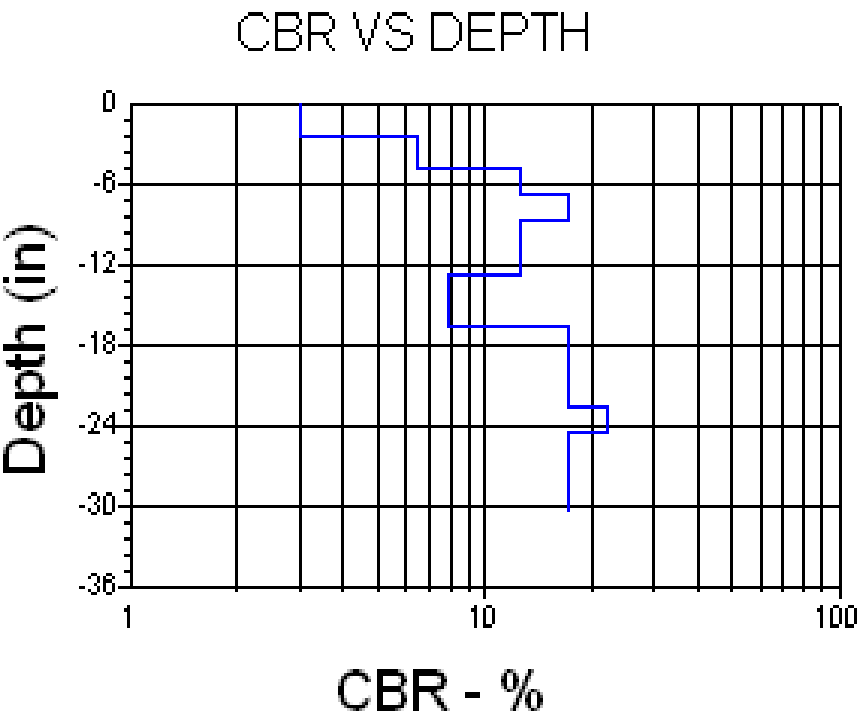


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635	UNASSIGNED 6.00" K 223	25
762	UNASSIGNED 3.25" K 246	30
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DCP TEST DATA

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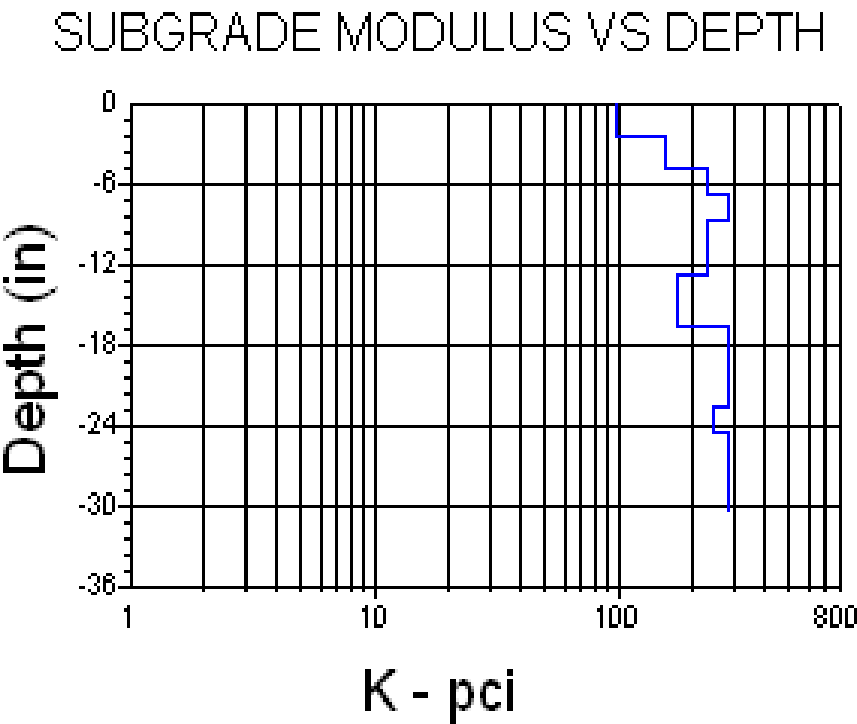


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635	UNASSIGNED 6.00" CBR 18	25
762	UNASSIGNED 6.00" CBR 17	30
889		35
1016		40
1143		45
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DCP TEST DATA

Project: Child Development Ctr (0-5YRS) -Tank Battalion AveDate: 7 January 2009

Feature: 10A-CDC(FY10)-10Station: 10A-CDC(FY10)-10



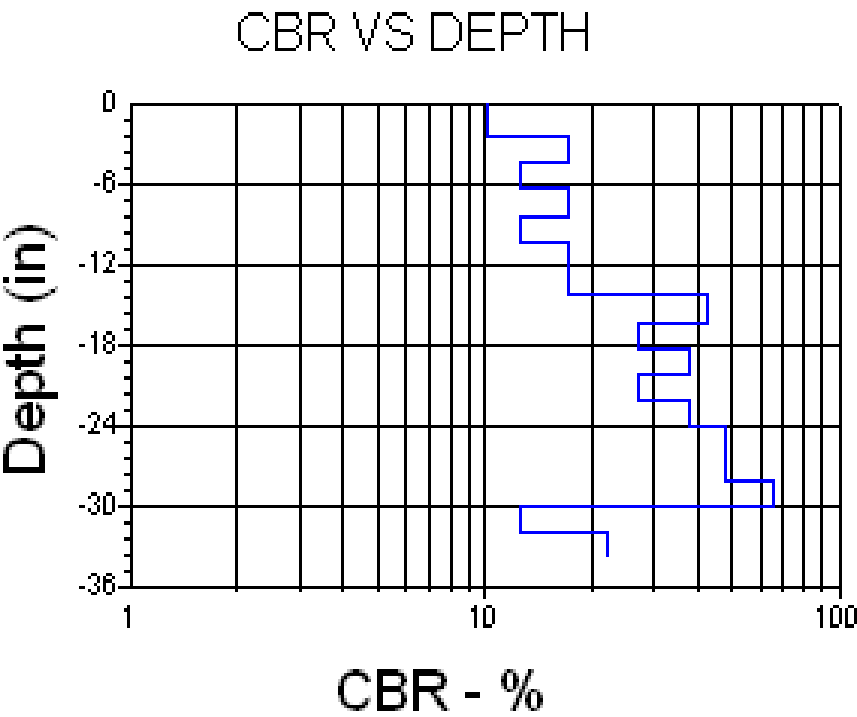
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889		35
1016		40
1143		45
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DCP TEST DATA

Project: Child Development Ctr (0-5YRS) -Tank Battalion AveDate: 7 January 2009

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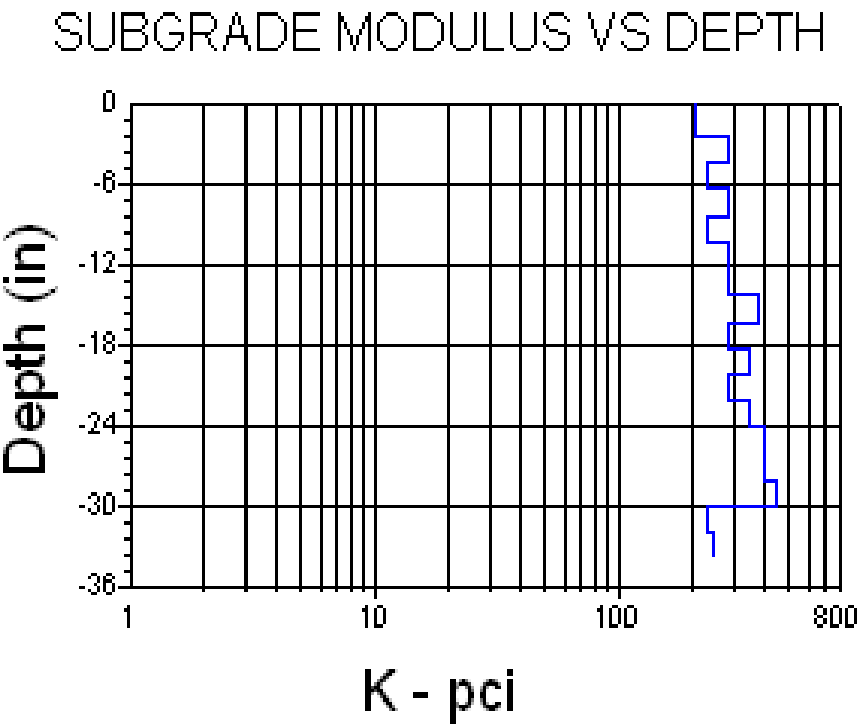


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DCP TEST DATA

Project: Child Development Ctr (0-5YRS) -Tank Battalion AveDate: 7 January 2009

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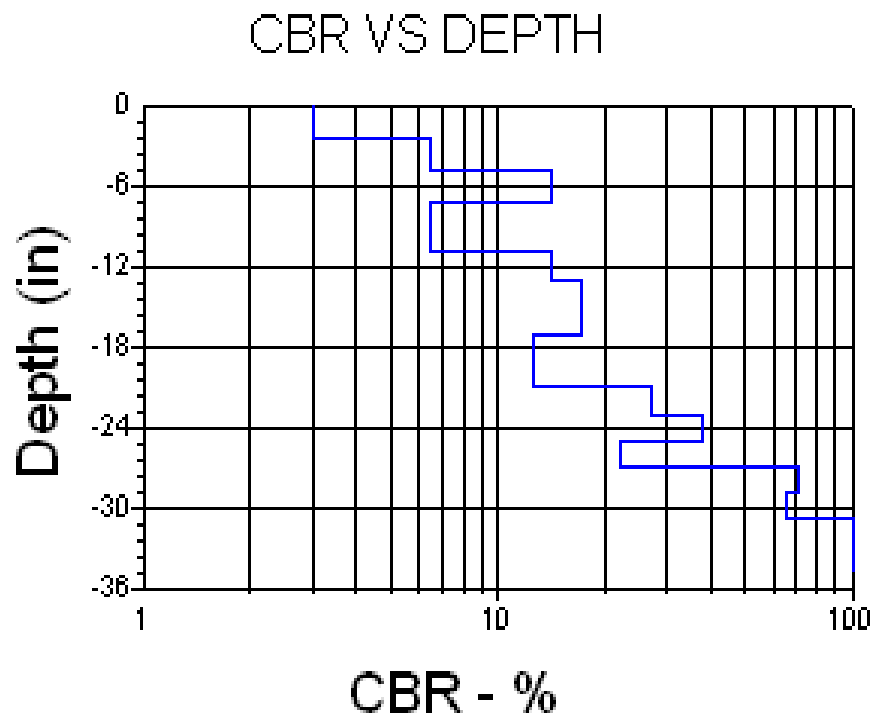


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635	UNASSIGNED 6.00" K 378	25
762	UNASSIGNED 4.00" K 240	30
889		35
1016		40
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1270		50

DCP TEST DATA

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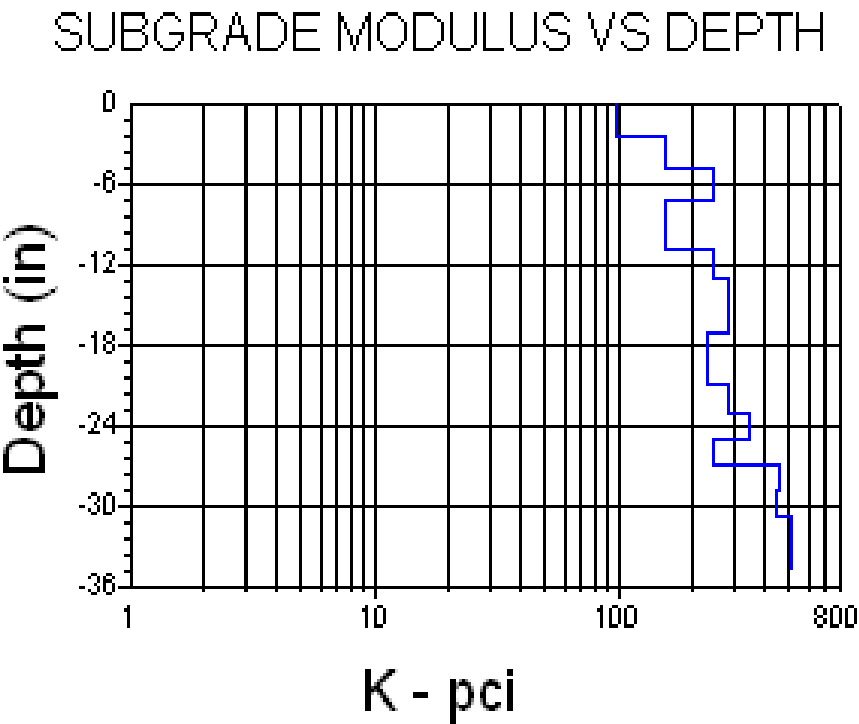


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508	UNASSIGNED 6.00" CBR 22	20
635	UNASSIGNED 6.00" CBR 48	25
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DCP TEST DATA

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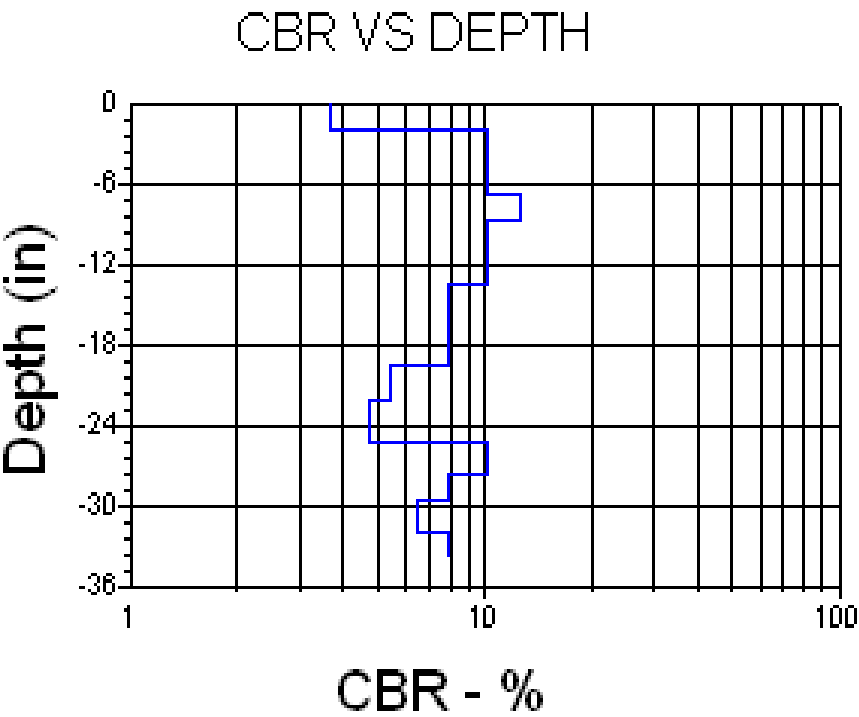


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635	UNASSIGNED 6.00" K 366	25
762	UNASSIGNED 4.75" K 492	30
889		35
1016		40
1143		45
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DCP TEST DATA

Project: Child Development Ctr (0-5YRS) -Tank Battalion AveDate: 7 January 2009

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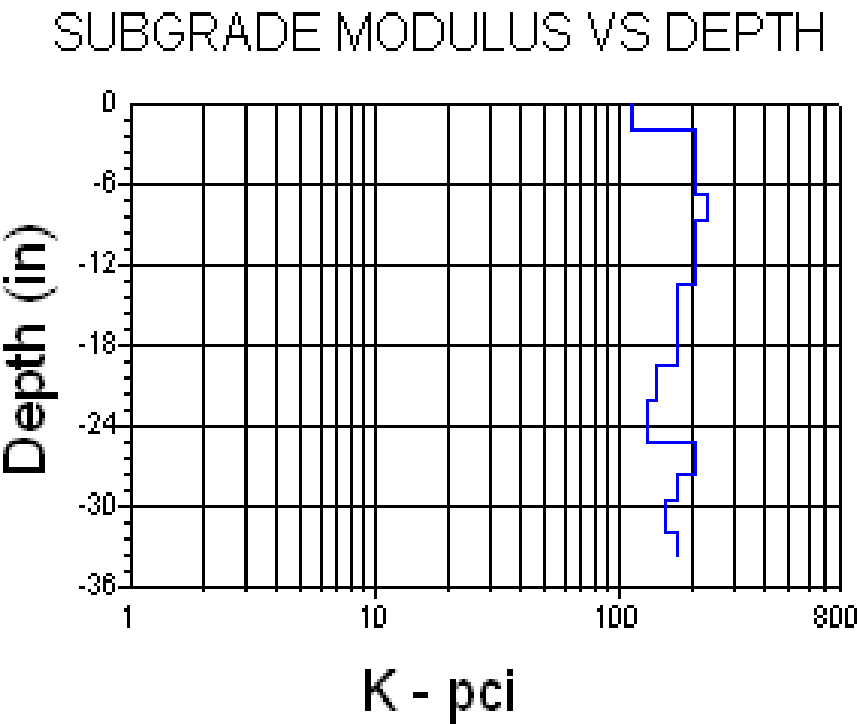


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635	UNASSIGNED 6.00" CBR 8	25
762	UNASSIGNED 4.00" CBR 7	30
889		35
1016		40
1143		45
1270		50

DCP TEST DATA

Project: Child Development Ctr (0-5YRS) -Tank Battalion AveDate: 7 January 2009

Feature: 10A-CDC(FY10)-13Station: 10A-CDC(FY10)-13



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508	UNASSIGNED 6.00" K 146	20
635	UNASSIGNED 6.00" K 174	25
762	UNASSIGNED 4.00" K 169	30
889		35
1016		40
1143		45
1270		50

## **APPENDIX E**

### **MAT FOUNDATION DESIGN CRITERIA**

WALLACE

REPLY TO  
ATTENTION OF

DEPARTMENT OF THE ARMY  
SOUTHWESTERN DIVISION, CORPS OF ENGINEERS  
1114 COMMERCE STREET  
DALLAS, TEXAS 75242-0216

CESWD-ED-TS/G (415a)

29 JAN 1988

## MEMORANDUM FOR:

Commander, Albuquerque District, ATTN: CESWA-ED  
✓ Commander, Fort Worth District, ATTN: CESWF-ED-DT  
Commander, Galveston District, ATTN: CESWG-ED  
Commander, Little Rock District, ATTN: CESWL-ED  
Commander, Tulsa District, ATTN: CESWT-ED

SUBJECT: Design Criteria for Ribbed Mat Foundations

1. This letter supersedes criteria letter, SWDED-TS/G, 23 Dec 1986, SAB.
2. The enclosed criteria shall be used for design of all ribbed mat foundations. This criteria has been revised to conform with the definition of swell pressure (soil-beam interface pressure) as presented in criteria letter, SWDED-G, 16 Apr 1987, subject: Criteria for Developing Geotechnical Design Parameters for SWD Ribbed Mat Design Methodology. Also, clarification has been provided for application of the PTI design method to family housing.
3. This criteria is furnished to addressees only.

FOR THE COMMANDER:

Encl

*William D. Denys*  
ARTHUR D. DENYS, P.E.  
Chief, Engineering Division

IV

7-01

10 YEARS OF SERVICE

TO THE SOUTHWEST



**DESIGN OF RIBBED MAT FOUNDATIONS**

**BY**

**JOSEPH P. HARTMAN**

**AND**

**B. H. JAMES**

**U.S. ARMY CORPS OF ENGINEERS**

**SOUTHWESTERN DIVISION**

**DALLAS, TEXAS**

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**REVISED**

**JANUARY 1988**

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## PART I - GENERAL REQUIREMENTS FOR RIBBED MATS

### 1. REFERENCES.

1.1 Engineering Instruction Manual, Corps of Engineers, Southwestern Division, (latest edition).

1.2 "Criteria for Selection and Design of Residential Slabs-on-Ground," Building Research Advisory Board (BRAB), Report No. 33 to the Federal Housing Administration, 1968.

1.3 "Design and Construction of Post-Tensioned Slabs-on-Ground," Post Tensioning Institute (PTI), 1980.

1.4 TM 5-818-7, Foundations in Expansive Soils, Corps of Engineers, 1983.

1.5 Letter, SWDED-G, 16 April 1987, Criteria for Developing Geotechnical Design Parameters for Ribbed Mat Design Methodology (Criteria Letter XV 7-12).

2. BACKGROUND. Ribbed mat foundations consist of a thin slab on grade which acts monolithically with a grid of stiffening beams beneath the slab. The beams (ribs) are cast in trenches dug in the foundation soil. Ribbed mats combine the economic advantages of shallow foundations with the performance advantages of monolithic floors. Ribbed mats are especially useful for minimizing differential foundation movements in areas with expansive soils.

### 3. DESIGN METHODS.

#### 3.1 EXPANSIVE SOILS.

##### 3.1.1 Behavior.

3.1.1.1 Center Lift. In the center lift condition the soil near the edge of the slab drops in relation to the soil near the center. This is due to moisture retention by the interior soils and the drying and shrinking of perimeter soils. As this occurs, the perimeter soil provides less support for the edge of the slab which then acts as a cantilever. This is illustrated in Figure A1 of Appendix A.

3.1.1.2 Edge Lift. In the edge lift condition the soil near the edge of the slab rises in relation to the soil near the center. This is due to the increasing moisture content and subsequent swelling of soil near the edge. The swelling soil raises the edge of the slab, causing some of the slab to lift off the soil. Interior loads cause the slab to sag and recontact the soil at some interior location. The slab thus tends to act as

a beam, simply supported by the soil at the edge, and by soil towards the center of the slab. The amount of support at the center depends on numerous parameters such as interior loads, rib bending stiffness, soil swell pressures, and the magnitude of soil swelling. Typical edge lift behavior is illustrated in Figure A3 of Appendix A.

3.1.2 SWD Method. All ribbed mats on expansive soils, except for family housing, shall be designed in accordance with the provisions of Part II of this report. Ribbed mats for family housing may be designed in accordance with Part II or paragraphs 3.1.3 or 3.1.4.

3.1.3 PTI Method. The PTI method (reference 1.3) may only be used for design of family housing foundations on expansive soils. Specifically, slab width (short dimension) should not exceed 40 feet, rib depths should not exceed 30 inches, loading should consist only of perimeter loads and light interior distributed loads ( $DL+LL \leq 100$  psf), soils should be fairly weak in-situ materials with no extensive substitution of non-expansive fill. When using the PTI method, the following provisions shall apply: Rib spacing shall not exceed 15 feet; concrete tensile stress shall not exceed  $4\sqrt{f'_c}$ ; the minimum effective prestress shall be 100 psi.

3.1.4 BRAB Method. The BRAB report (reference 1.2) may only be used for design of foundations for family housing. However, the PTI method is preferred, since the BRAB method may produce unreasonable results for large foundations.

3.1.5 Computer Method. In lieu of paragraph 3.1.2, ribbed mats may be designed using appropriate computer programs. Such programs must be capable of modeling the variable soil swell due to moisture changes, and the non-linear soil-structure interaction near the perimeter of the foundation. One such computer program is CBEAMC, program X0050 in the Corps of Engineers Civil Engineering Library.

3.1.6 Load Factors. When using the above methods to design ribbed mats for center lift and edge lift conditions, load factors may be multiplied by .75 (strength method) or allowable stresses may be increased by one-third (working stress method). This provision does not apply to the allowables given for the PTI method, since those allowables have already been increased from the usual provisions of ACI.

3.2 NON-EXPANSIVE SOILS. Ribbed mat slabs on non-expansive soils need not be designed for bending due to center lift or edge lift conditions. Beam on elastic foundation analyses may be used to determine the effects of concentrated loads on ribs, or ribs may be designed as conventional strip or spot footings.

3.3 SOIL PROPERTIES. Soil properties for design of ribbed mats will be provided in the Foundation Design Analysis by the Corps of Engineers. Criteria for developing these properties is included in reference 1.5. The properties necessary for design in accordance with paragraph 3.1.2 consist of the following, which are defined in Appendix A:

- qa - allowable bearing pressure
- k - subgrade modulus
- Ym - soil heave
- Lm - edge moisture variation distance
- Psw - pressure of swelling soil acting on perimeter rib

#### 4. MINIMUM REQUIREMENTS.

4.1 SUBGRADE PREPARATION. A vapor barrier, capillary water barrier, and a minimum of 18 inches of non-expansive fill will normally be used beneath ribbed mats. Additional non-expansive fill will often be used to lessen the effects of highly expansive soils. These requirements will be detailed in the Foundation Design Analysis.

4.2 SLAB. For family housing and other small lightly loaded buildings a 4 inch slab may be used. For other buildings the minimum slab thickness will be 5 inches. Minimum slab reinforcing shall be 0.2 percent. Where slabs are subjected to vehicular loading they must be designed for the maximum wheel load, similar to paving. Use 650 psi flexural strength concrete for slabs subject to wheel loads.

4.3 GRID GEOMETRY. Ribs should be located to form a continuous grid. Rib spacing should not exceed 20 feet in expansive soils, or 25 feet in non-expansive soils. Locations of ribs should conform to significant wall and column loads, and may be used to resist thrusts from rigid frame reactions. Ribs should be provided around large openings in the slab. In expansive soils diagonal ribs are required at exterior corners.

Expansion joints should be provided at 250 foot intervals, and should also be used to break irregularly shaped buildings into rectangular segments. Foundations for family housing do not require expansion joints due to irregular shapes.

4.4 RIB SIZE. Minimum rib depth is 20 inches. Rib depths should usually not exceed 3 feet to minimize construction difficulties related to placing reinforcement and maintaining trench walls. If deeper ribs are used, rib width should also be increased. Minimum rib width is 12 inches except for family housing foundations, where 10 inch ribs may be used. Sufficient rib width must also be provided to transfer wall and column loads to the soil as strip footings. The allowable soil bearing capacity may not be exceeded when considering the width of the rib plus an effective slab width on each side of the rib. The

effective slab width for bearing is limited to the thickness of the slab. At column locations an alternate is to provide fillets at rib intersections, sufficient to act as spot footings for column loads.

4.5 RIB CAPACITY. Concrete should have a minimum compressive strength of  $f'_c=3000$  psi at 28 days. Reinforcing shall be grade 60, except ties may be grade 40. Minimum reinforcing ratio ( $A_s/A_g$ ) shall be .0033 top and .0033 bottom, this may be reduced to .005 total in non-expansive soils. Use #3 ties at 24 inches, minimum. These minimums should be sufficient for shrinkage stresses and for unpredictable soil behavior.

4.6 PRESTRESSED MATS. For prestressed ribbed mats, not designed per PTI, all the above minimum requirements apply except that slab and rib top reinforcement may be deleted and replaced by appropriate post-tensioning strands. Mild steel shall still be provided in the bottom of ribs. Minimum effective prestress shall be 100 psi on the gross area of the slab, including effects of subgrade friction as calculated by the PTI method, reference 1.3. Concrete tensile stress shall be limited to  $3/\sqrt{f'_c}$  and shear stress limited to  $1.1/\sqrt{f'_c}$ . A one-third overstress may be allowed per paragraph 3.1.6.

#### 4.7 CONSTRUCTION DETAILS.

4.7.1 Conventionally Reinforced. Construction joint spacing should not exceed 50 feet in either direction. A horizontal construction joint may be provided in the ribs at the base of the capillary water barrier when unstable trench walls may cause construction difficulties. However, this joint is discouraged because of increased potential for shrinkage cracks in the slab.

4.7.2 Prestressed. Construction joint spacing shall not exceed 75 feet in either direction. Tendons within each placement shall be stressed to 15 percent of the final prestress not more than 24 hours after the concrete has attained sufficient strength to withstand the partial prestress. Other construction procedures for prestressed ribbed mats shall conform to reference 1.3.

4.7.3 Contractor Designs. Ribbed mat foundations may be designed as prestressed or conventionally reinforced as selected by the engineer. The plans and specifications shall not include the option of changing the ribbed mat from one type to another. The reason for this prohibition is that design parameters (e.g., moments of inertia) may be dependent on the type of ribbed mat being designed and may affect calculated shears and moments. This does not prohibit revisions of the slab type as a result of contractor value engineering proposals. However, such revisions must include a complete design of the ribbed mat foundation using appropriate design parameters in accordance with this report.

## PART II - ANALYSIS OF RIBBED MAT FOUNDATIONS ON EXPANSIVE SOILS

1. SCOPE. This part of the report contains the basic rules for design of ribbed mats in expansive soils. This method may be used to predict shears, moments and deflections in ribs subject to soil movement due to changing moisture content. For a commentary on the design method refer to Appendix A; for example design calculations refer to Appendix B. The design method from Part II should be used in conjunction with the "minimum requirements" for ribbed mats, as presented in Part I.

### 2. GENERAL

#### 2.1 NOTATION.

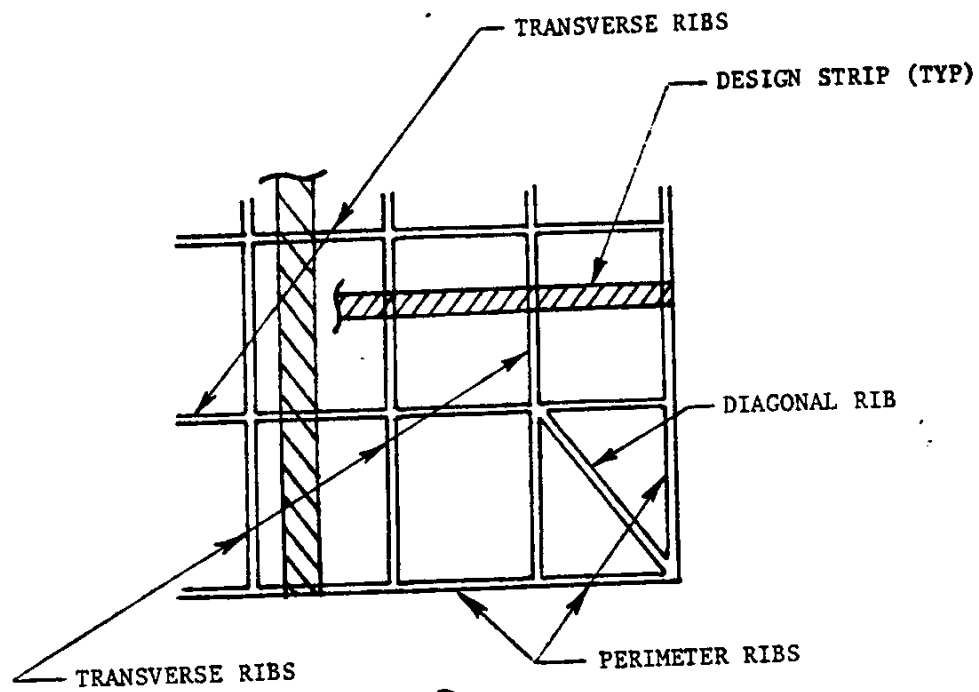
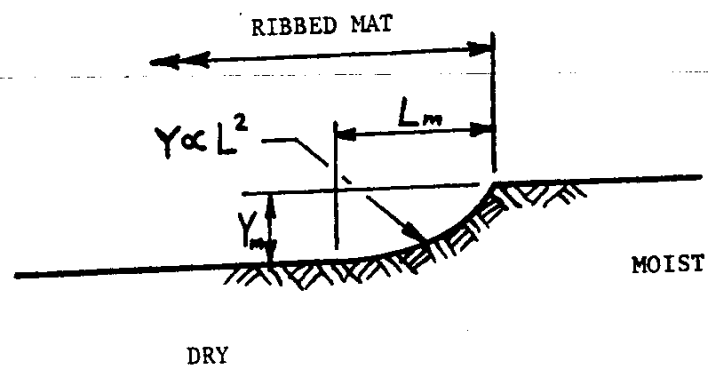
C	= Correction factor for equivalent cantilever length
D	= Beam deflection (IN)
I	= Moment of inertia per foot, $I = I_r/S$ (IN <sup>4</sup> /FT)
$I_r$	= Moment of inertia of rib (IN <sup>4</sup> )
* k	= Modulus of subgrade reaction (PCI)
$L_o$	= Basic length of cantilever (FT)
$L_c$	= Equivalent length of cantilever, center lift (FT)
$L_e$	= Equivalent length of simple beam, edge lift (FT)
$L_i$	= Distance from perimeter to location of interior load (FT)
* $L_m$	= Edge moisture variation distance (FT)
$L_b$	= Width of soil bearing at perimeter, edge lift (FT)
M	= Bending moment per foot (FT-LB/FT)
$M_r$	= Bending moment per rib, $M_r = M \times S$ (FT-LB)
$P_i$	= Interior load (PLF)
$P_p$	= Perimeter load (PLF)
* $P_{sw}$	= Pressure of swelling soil on perimeter rib (PSF)
R	= End reaction at perimeter for equivalent simple beam (PLF)
S	= Rib spacing (FT)
w	= Uniform load (PSF)
V	= Shear per foot (LB/FT)
$V_r$	= Shear per rib, $V_r = V \times S$ (LB)
* $Y_m$	= Soil heave (IN)
$\theta$	= Rotation of support of equivalent cantilever (RAD)

\*  $q_a$  = ALLOWABLE  
BEARING  
PRESSURE  
(PSF)

2.2 UNITS. The equations presented in section 3 are written for units as defined in the above notation. If other units are used the equations must be modified appropriately.

2.3 RIB DEFINITIONS. Ribs are defined as perimeter, transverse or diagonal as shown in Figure 1. Note that transverse refers to ribs parallel to either axis of the building.

\* VALUES NEEDED FROM GEOTECH

FIGURE 1 - RIB DEFINITIONSFIGURE 2 - SOIL EDGE PROFILE



2.4 STRIP ANALYSIS. The analysis is based on a strip assumption, ignoring the effects of the grid configuration of the ribs. The formulas and examples presented below are for an equivalent 1-foot strip, using "per foot" values for loads and stiffness.

2.5 SOIL EDGE PROFILE. For edge lift the maximum swell occurs at the perimeter and decreases rapidly toward the interior. The soil profile is assumed to be parabolic (in the unloaded condition) and is illustrated in Figure 2.

### 3. ANALYSIS METHOD.

#### 3.1 TRANSVERSE RIB - CENTER LIFT.

3.1.1 General. Center lift analysis is based on an equivalent cantilever beam to determine moments, shears and deflections.

3.1.2 Moment. The length of the equivalent cantilever can be calculated as:

$$L_c = C \times L_o$$

where:  $L_o = 2.3 + .4 L_m$

$$C = .8 Y_m^{.12} I^{.16} / P_p^{.12}$$

The maximum moment may then be calculated from statics using conventional cantilever formulas such as:

$$M = P_p L_c + 1/2 w L_c^2$$

The moment can then be assumed to be constant for a distance  $L_c/2$  and then to decrease linearly to zero at a distance  $5L_c$  from the perimeter. To obtain the design moment for a given rib, multiply the calculated per-foot moment by the appropriate rib spacing ( $M_r = M \times S$ ).

3.1.3 Shear. The maximum shear may be calculated from statics using the same equivalent cantilever as for moment.

$$V = P_p + w L_c$$

The shear may then be assumed to decrease linearly from  $V$  at the cantilever support, to zero at a distance  $5L_c$  from the perimeter. To obtain the design shear for a given rib, multiply the calculated per-foot shears by the appropriate rib spacing ( $V_r = V \times S$ ).

3.1.4 Deflection. Deflection at the perimeter is the sum of three components: bending deflection of the equivalent cantilever, vertical translation of the cantilever support, and rotation

of the cantilever support. Rotation of the support may be calculated as:

$$\theta = M^{1.4} / 9800 I k^{.5}$$

The perimeter deflection is then:

$$D = .11 + 12 L_c \theta$$

where .11 inches is an approximation for the support translation plus the cantilever bending, and (12 L<sub>c</sub>) is the length in inches.

Use the deflection calculated above to compare with allowable deflection. The allowable deflection may be determined by using 4L<sub>c</sub> as the length between points of zero and maximum deflection.

### 3.2 TRANSVERSE RIB - EDGE LIFT.

3.2.1 General. Edge lift analysis is based on an equivalent simple beam, supported at the perimeter and at some interior location.

3.2.2 Deflection. The first step in calculating deflection is to determine the length of the equivalent simple beam. The appropriate length depends on many parameters, including the deflection. Therefore, deflection must first be estimated to determine equivalent length, then a deflection is calculated based on that length. The process is repeated until calculated deflection matches the assumed deflection. The equivalent simple beam length may be calculated as:

$$L_e = 7.5 I^{.17} L_i^{.37} D^{.12} / w^{.07} P_i^{.11}$$

The perimeter end reaction for this beam may be calculated from statics. For a given case the reaction may be:

$$R = P_p + 1/2 w L_e + P_i(L_e - L_i)/L_e$$

The width of soil bearing at the perimeter can be approximated as:

$$L_b = 1.1 (R/P_{sw})$$

where P<sub>sw</sub> is selected from a curve of heave versus bearing pressure, corresponding to the estimated deflection used during this iteration (see reference 1.5).

The edge deflection is found by determining the soil swell at a distance L<sub>b</sub> from the perimeter, based on the parabolic swell profile:

$$D = Y_m(L_m - L_b)^2 / L_m^2$$

When satisfying deflection criteria, use the calculated deflection and equivalent simple beam length.

3.2.3 Moment. Once the simple beam equivalent length has been determined, the bending moments may be calculated based on statics. To obtain rib design moments, multiply per-foot moments by the rib spacing.

3.2.4 Shear. Once the simple beam equivalent length has been determined, the shears may be calculated based on statics. To obtain rib design shears, multiply per-foot shears by the rib spacing. Near the interior support the design shear need not exceed:

$$V = P_i + w(L_e - L_i)$$

This is due to the effects of the actual distributed soil support, rather than the point support assumed in the simple beam analysis.

3.2.5 Special Cases. If  $P_i=0$  or if  $L_i > L_e$  make the following substitution in the equation for  $L_e$ :

$$1.4 = L_i^{.37} / P_i^{.11}$$

The equation for the simple beam length then becomes:

$$L_e = 10.5 I^{.17} D^{.12} / w^{.07}$$

### 3.3 PERIMETER RIB.

3.3.1 Center Lift. For center lift the perimeter rib will have no support from the soil and must be designed to span between transverse ribs for the perimeter wall loads.

3.3.2 Edge Lift. For edge lift the soil pressure on the perimeter rib will exceed the applied perimeter loads. The perimeter rib must be designed to span between transverse ribs for this net upward force.

3.4 DIAGONAL RIB. Diagonal ribs are used to support exterior corners for center lift conditions, if loss of support occurs under both perimeter ribs. Diagonal ribs must be designed to provide the same moment and shear capacity as the larger of the two adjacent transverse ribs.

3.5 INTERIOR RIB. Interior ribs and rib intersections should be located at significant wall and column loads. The ribs can be designed for these loads as strip or spot footings, using beam-on-elastic-foundation methods. Differential soil movement due to moisture change is assumed not to occur except at the perimeter. However, to account for unpredictable interior soil movements, interior ribs must have the minimum size and capacity as required in Part I.

## APPENDIX A - COMMENTARY ON PART II

1. SCOPE. Actual behavior of ribbed mats in expansive soils involves complex, non-linear, soil-structure interaction. The best solution for such behavior is provided by computer programs. The hand design method has been developed to approximate such computer results. Hand solutions have been checked by computer analyses; results have been within acceptable limits of error. However, such checks have been made only for a limited range for each design parameter, as shown in Table A1, corresponding to the usual values for military construction within Southwestern Division. If a wider range of parameters is applied to the hand design formulas, the results may be less accurate.

TABLE A1

Parameter	Units	Minimum	Maximum
k	pci	50	200
Ym	in	0.5	3.0
Lm	ft	2	8
I	in <sup>4</sup> /ft	750	6000
Pp	lb/ft	1000	5000
Pi	lb/ft	0	5000
Li	ft	6	20
w	psf	100	250
Psw	psf	2000	8000

## 2. GENERAL.

## 2.1 NOTATION.

$I_r$  = moment of inertia of rib. For non-prestressed rib mats  $I_r$  should be the effective moment of inertia, calculated per ACI 318, Section 9.5.2.3.

$k$  = Modulus of subgrade reaction. This parameter is the ratio of the soil pressure at the base of the concrete and the corresponding settlement. Since modulus values are typically determined by plate-load test at the ground surface, they should be corrected for depth and for footing size (expected high pressure area between concrete and soil). Analyses have indicated that the high bearing pressure area for center lift conditions will occur in an area several feet long parallel to the transverse rib and several feet on each side of the rib. A crude approximation for this area would be 5 feet square. This approximation should be adequate for design, since calculations are not sensitive to small changes in the modulus of subgrade reaction.

$q_a$  = Allowable bearing pressure. This is the safe bearing capacity of the soil at the base of the ribs. A factor of safety of 3.0 is recommended for computing this value.

$L_m$  = Edge moisture variation distance. This represents the distance, inward from the edge of the slab, over which the moisture content of the soil changes. Much judgement is required in determining this value.

$P_{sw}$  = Pressure of swelling soil on perimeter rib. This is the interface pressure between the soil and the base of the exterior rib, due to an increase in soil moisture content. The pressure which can be exerted by the swelling soil is dependent on the amount the surface of the soil is allowed to rise. Therefore  $P_{sw}$  is usually presented as a curve of pressure versus heave, as described in reference 1.5 of Part I. The actual upward deflection of the edge of the slab is a complex interaction between swell potential, structural loads, and mat stiffness, all of which combine to determine the interface pressure near the perimeter.

$Y_m$  = Soil heave. This is the differential vertical movement of the soil representing either soil heave (edge lift) or soil shrinkage (center lift). The magnitude of  $Y_m$  is the computed vertical movement of a particle of soil at the ground surface due to a change in moisture content. This value should be based on the accumulation of potential volume changes for the full thickness of the active zone ( $Z_a$ ), with no significant loads applied to the foundation. The value of  $Y_m$  may differ for edge lift and center lift conditions.

$P_i$ ,  $P_p$ ,  $w$  = Applied loads. Loads should consist of full dead plus live loads, including dead load of the slab and ribs.

## 2.2 UNITS.

## 2.3 RIB DEFINITIONS.

2.4 STRIP ANALYSIS. The hand solution formulas have been developed for analysis of an equivalent 1 foot strip. This is convenient for uniform loads and for soil properties, but requires some calculations for appropriate concentrated loads and bending stiffness. Rib stiffness must be divided by rib spacing to get the per-foot stiffness. If column loads exist they must also be divided by the rib or column spacing to provide an equivalent load per foot. If interior wall loads are parallel to the transverse rib, they must be divided by the rib spacing. These calculations are illustrated in Appendix B.

2.5 SOIL EDGE PROFILE. The edge lift condition occurs when increased moisture content swells exterior soils, and this effect extends under the edge of the slab. The center lift condition occurs when soils under the slab are generally moist and seasonal drying occurs on the exterior, again extending under the slab. This causes the soil to shrink away from the edge of the slab.

The analysis method is based on an assumed parabolic swell profile which occurs uniformly along the perimeter. This is a convenient idealization of actual soil behavior, which is certainly more erratic. However, the parabolic profile has better correlation with measured swells than do other possible edge profile assumptions. Note that the soil profile is not used in the hand design formulas for center lift. However, a parabolic profile was used in the computer analyses for center lift, which formed the basis for the hand design formulas.

3. ANALYSIS METHOD. Many of the formulas for shears, moments and reactions are idealized, assuming  $P_p$  and  $R$  are exactly at the perimeter and that  $w$  extends to the perimeter. These approximations should usually be acceptable, but the formulas may be modified to account for actual load patterns.

### 3.1 TRANSVERSE RIB - CENTER LIFT

3.1.1 General. Typical behavior of a transverse rib for center lift conditions is shown in Figure A1. This illustrates the soil bearing pressure and the shear, moment and deflection. Note that the effects of the soil movement extend much farther than the moisture variation distance. The moment and shear distribution close to the edge resemble cantilever behavior.

3.1.2 Moment. The extent of significant moments is illustrated in Figure A1. The length of the equivalent cantilever can be taken as a basic length ( $L_0$ ) which is dependent on the moisture variation distance, times a correction factor ( $C$ ) which accounts for secondary effects of several parameters. The value of the correction factor will usually be slightly greater or less than unity. The correction factor was developed to permit accurate approximations of computer results. It was developed from the ratios of actual values to usual values for significant parameters. For example, the "usual" values are:  $Y_m = 1$  in,  $I = 1500$  in<sup>4</sup>/ft,  $P_p = 3000$  lb/ft. Thus:

$$C = (Y_m/1.0)^{.12} (I/1500)^{.16} (3000/P_p)^{.12}$$

$$C = .8 Y_m^{.12} I^{.16} / P_p^{.12}$$

A similar approach was used to develop all the formulas in Part II which have an exponential format.

3.1.3 Shear. Maximum shear occurs near the support of the equivalent cantilever. The extent of significant shears is illustrated in Figure A1.

3.1.4 Deflection. Formulas for deflection include an assumed concrete modulus of elasticity  $E_c = 3,320,000$  psi, for both center lift and edge lift.

Vertical movement at the perimeter is much greater than the bending deflection of the equivalent cantilever. To predict the deflection it is necessary to consider translation and rotation at the support of the equivalent beam. The most significant component is due to rotation at the support. These

components of deflection are shown in Figure A2. The sum of the cantilever bending and the support translation are approximated by the value 0.11 inch. The percent error due to this approximation is negligible when total deflections are large. The percent error is greater when total deflections are small, but then the deflections are not significant anyway.

Allowable deflections (see Part I, reference 1.1) are expressed as a ratio of the difference in vertical movement at any two points, compared to the distance between those points. For example:  $D \leq L/600$ , where  $D$  is the differential displacement. In such formulas it is appropriate to use the point of maximum deflection and a point of near-zero deflection as the two measuring points. For center lift behavior the maximum deflection occurs at the perimeter, and deflections tend to die out at approximately  $4L_c$  (four times the equivalent cantilever length) from the perimeter. Therefore, the ratio  $D/4L_c$  is appropriate for comparison with allowable deflections.

### 3.2 TRANSVERSE RIB - EDGE LIFT.

3.2.1 General. Typical behavior of a transverse rib for edge lift conditions is shown in Figure A3. This illustrates the soil bearing pressure and the shear, moment and deflection. Soil swell lifts the edge of the ribbed mat, which actually rises off the soil for some distance from the perimeter. For shear and moment, this portion of the rib acts as a simply supported beam spanning between soil support at the perimeter and at an interior location.

3.2.2 Deflection. Vertical movement at the perimeter is driven by the tendency of the soil to swell, and is resisted by the downward loads applied on the soil. As the soil swells at the perimeter the slab is lifted off the interior soil. This concentrates soil reactions near the edge, causing very high pressures. The pressures rise so high that they limit the capacity of the soil to swell. Thus, the soil cannot swell as much as it would if not loaded. Deflections can be predicted by balancing the upward force of the soil (the swell pressure times the bearing width) with the downward force of applied loads. This downward force can be determined from statics once an equivalent simple beam length is determined. The method for determining the deflection is shown in Figure A4.

Allowable deflections are expressed as ratios, as discussed in the commentary on paragraph 3.1.4. From Figure A3 it can be seen that the appropriate values for this ratio are the edge deflection and the equivalent simple beam length ( $D/L_c$ ).

Edge lift deflections are mainly a function of soil properties and applied loads, bending stiffness of the ribs has only a secondary effect. Therefore, it may not be possible to control deflections by increasing the rib stiffness. It may be necessary to accommodate calculated deflections by using a less brittle superstructure or by detailing the superstructure to make it less sensitive to deflections. Or it may be necessary to modify soil properties to minimize the edge heave.

3.2.3 Moment. The moments can be calculated by statics, using the equivalent simple beam. The maximum moment will occur at the point of zero shear. Note that the maximum moment is quite sensitive to the beam length, therefore the iterative solution for deflection and appropriate swell pressure must converge accurately before calculating moments.

3.2.4 Shear. Shears can also be calculated by statics from the equivalent simple beam. Note that shears will reduce gradually to near-zero around the interior end of the beam because of the distributed soil support.

3.2.5 Special Cases. If no concentrated interior load exists, or if it is very far from the perimeter, the formula for the simple beam length must be adjusted as shown. This adjusted formula was also developed to duplicate results from computer solutions.

### 3.3 PERIMETER RIB.

### 3.4 DIAGONAL RIB.

3.5 INTERIOR RIB. Potential soil heaves in the interior are unpredictable and are generally due to localized moisture conditions, for example, due to a leaking pipe. Such conditions cannot be accounted for by design formulas. Adequate strength and stiffness for such unpredictable heaves should be supplied by the minimum requirements listed in Part I of the report. For interior wall or column loads the interior ribs should be designed in accordance with Part I, section 3.2.



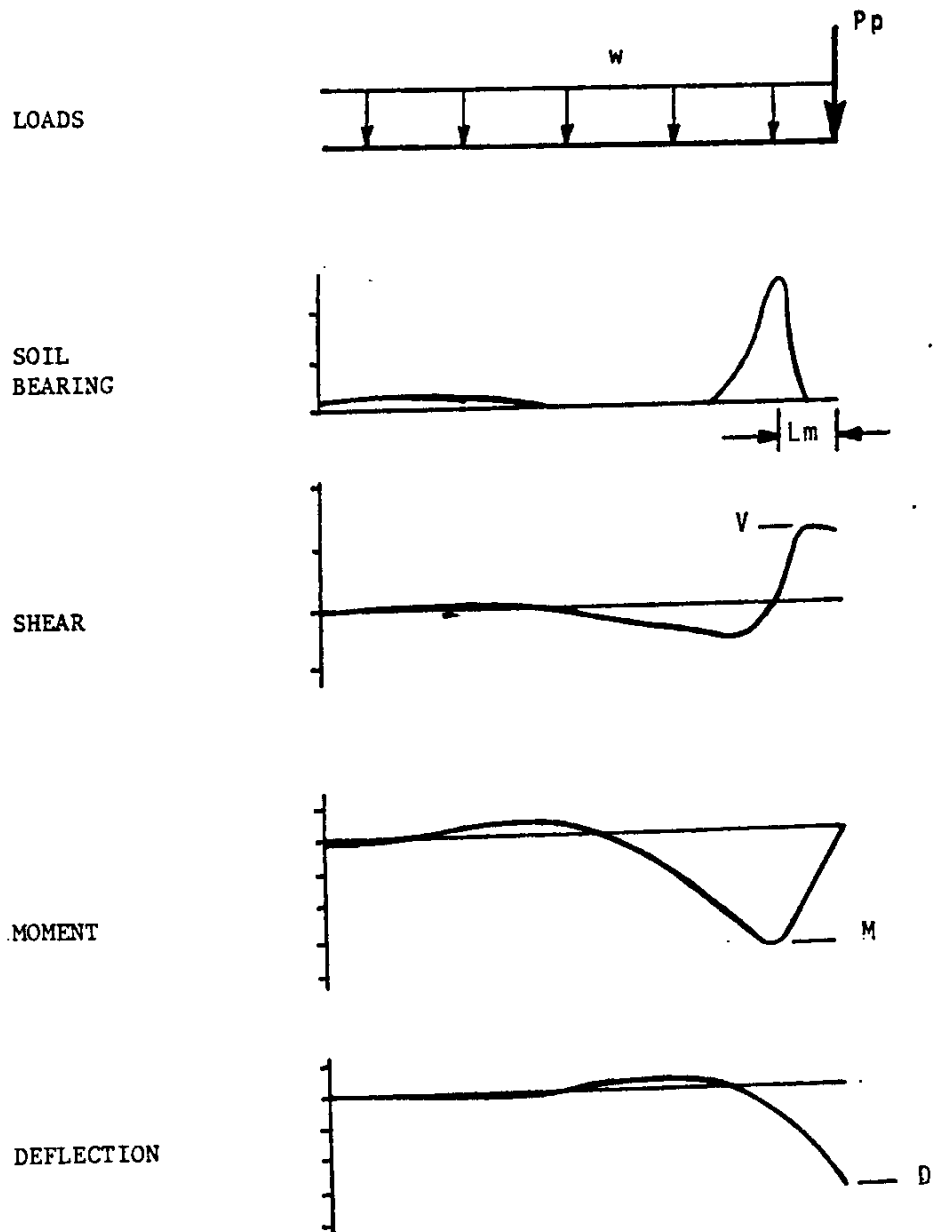
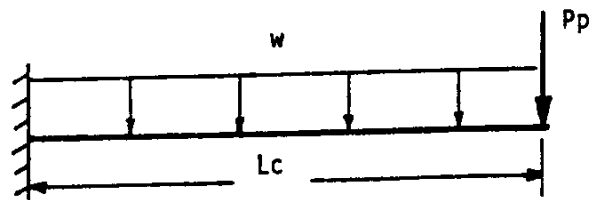
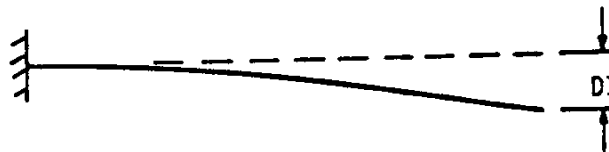
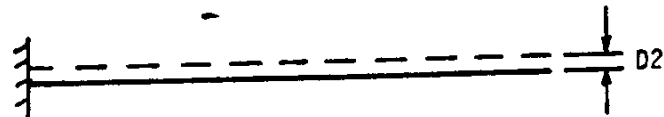
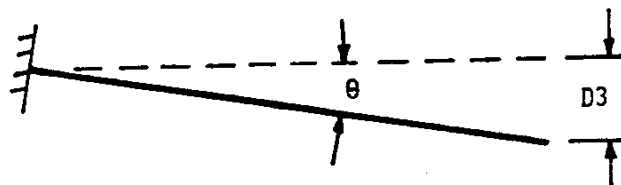
FIGURE A1 - CENTER LIFT BEHAVIOR

FIGURE A2 - CENTER LIFT DEFLECTIONEQUIVALENT  
CANTILEVERCANTILEVER  
BENDINGSUPPORT  
TRANSLATIONSUPPORT  
ROTATION

$$D = D1 + D2 + D3$$

$$D1 + D2 = .11$$

$$D3 = 12 Lc \theta$$

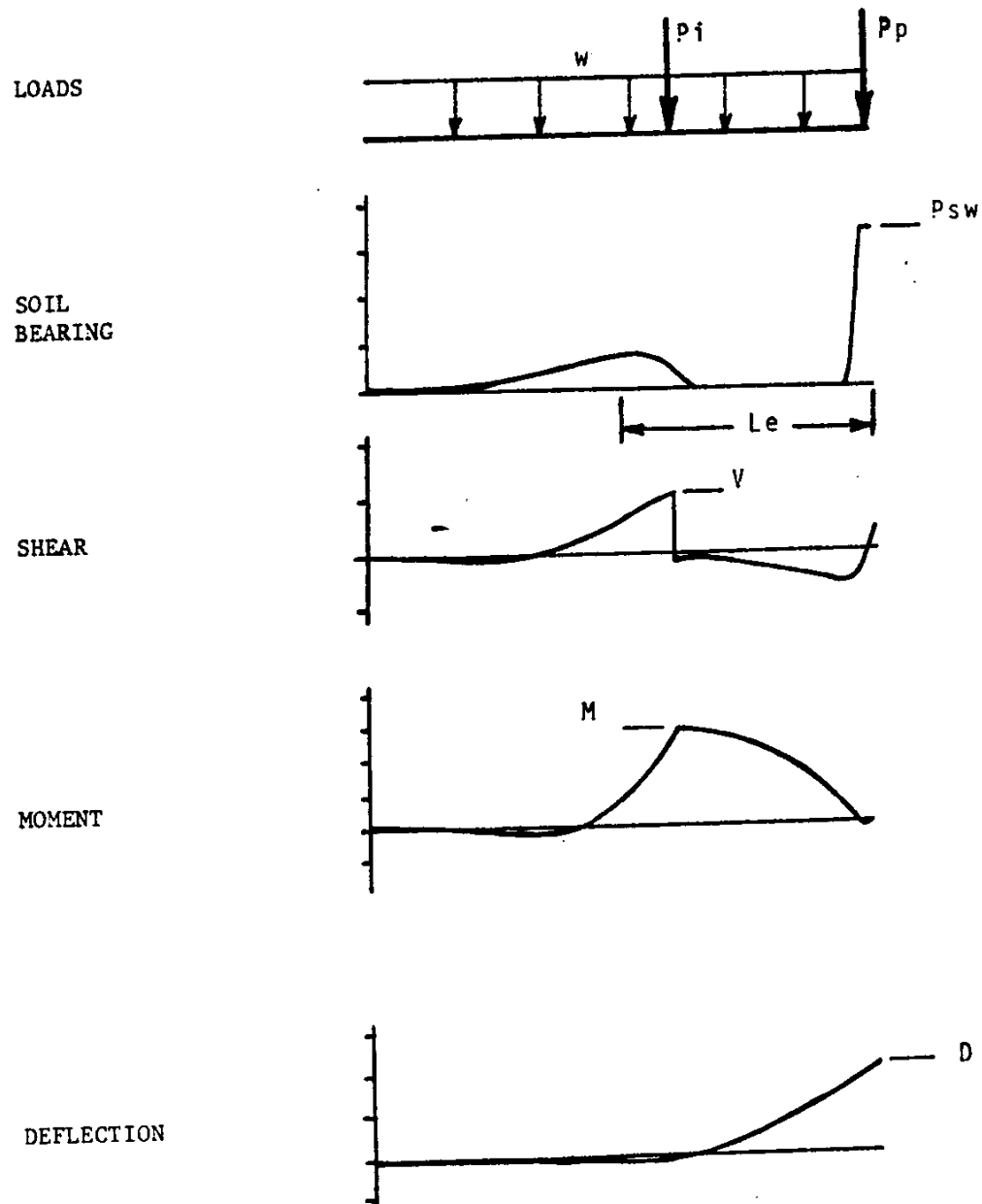
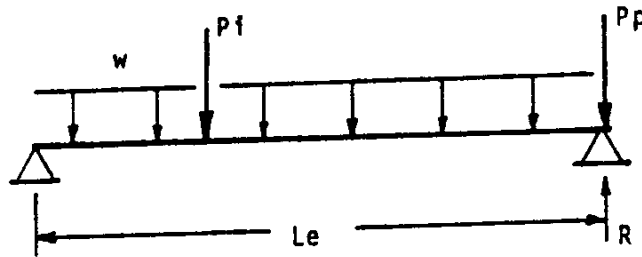
FIGURE A3 - EDGE LIFT BEHAVIOR

FIGURE A4 - EDGE LIFT DEFLECTION

EQUIVALENT  
SIMPLE BEAM



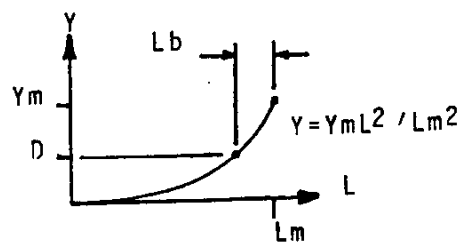
DEFLECTED  
SHAPE



BEARING  
PRESSURE



SOIL  
EDGE  
PROFILE

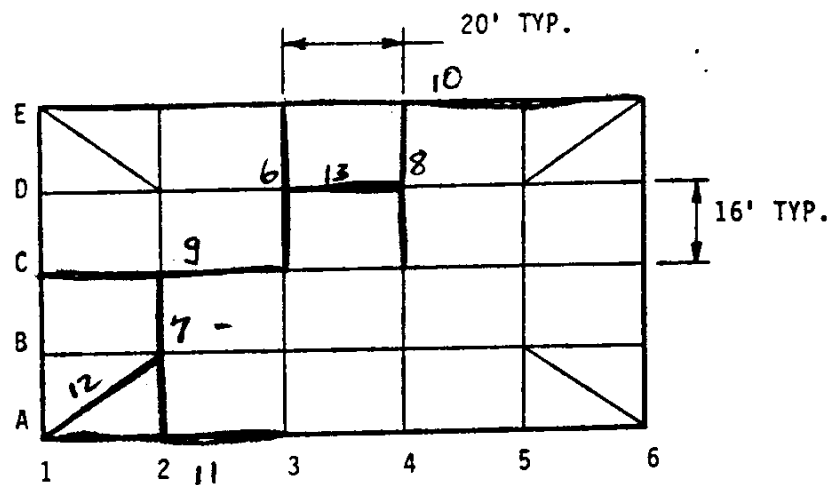


APPENDIX B - DESIGN EXAMPLE  
(RIBBED MAT DESIGN IN EXPANSIVE SOIL)

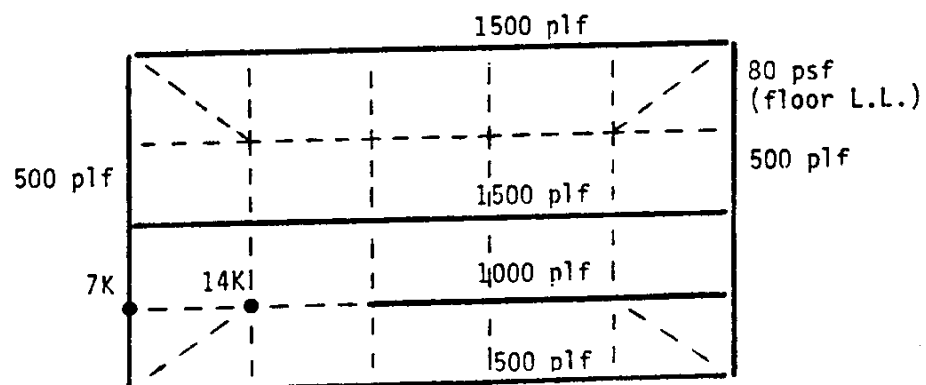
1. SOIL DATA (ref. Part I - 3.3)

$q_a = 2000 \text{ psf}$   
 $P_{sw} = (\text{see page B9})$   
 $k = 100 \text{ pci}$   
 $L_m = 6 \text{ ft}$   
 $Y_m = 1.5 \text{ in for center lift}$   
 $Y_m = 1.0 \text{ in for edge lift}$

2. FOUNDATION PLAN (ref. Part I - 4.3)



3. LOADS



B1

## 4. BEARING DESIGN FOR RIBS (ref. Part I - 4.4)

Maximum wall load (P) = 1500 plf

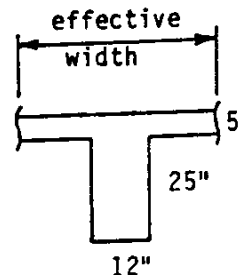
Width  $\geq P/q_a = 1500/2000 = .75$  ft

Use 12 inch wide ribs (minimum)

## 5. INTERIOR RIB PROPERTIES (ref. Appendix A - 2.1)

$E_c = 3,320,000$  psi

(effective flange width  
per ACI 318, section 8.10.2  
For "span length" use  $4L_c$   
for center lift or  $L_e$  for  
edge lift)



Let  $I_r = 36,000$  in<sup>4</sup> for center lift  
 $I_r = 24,000$  in<sup>4</sup> for edge lift  
 (ref. ACI 318, section 9.5.2.3, verify  $I_r$  after  
 calculating M)

$I = I_r/S$  (in<sup>4</sup>/ft):

Rib spacing	16 ft	20 ft
Center lift	2250	1800
Edge lift	1500	1200

## 6. CENTER LIFT DESIGN - RIB E3/C3

## 6.1 Loads (ref. Appendix A - 2.1)

slab weight = 150 pcf x 5/12 ft = 62 psf

$w = DL + LL = 62 + 80 = 142$  psf

rib weight = 150 pcf x 2.5 ft x 1.0 ft = 375 plf

$P_p = \text{rib} + \text{wall} = 375 + 1500 = 1875$  plf

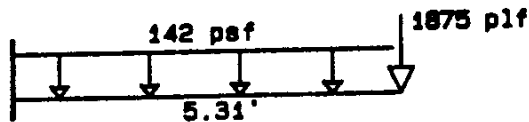
## 6.2 Equivalent cantilever (ref. Part II - 3.1)

$$L_o = 2.3 + .4 L_m = 2.3 + (.4 \times 6) = 4.7 \text{ ft}$$

$$C = .8 Y_m \cdot I^{.16} / P_p \cdot I^{.12}$$

$$C = .8 \times 1.5 \cdot 1800 \cdot I^{.16} / 1875 \cdot I^{.12} = 1.13$$

$$L_c = L_o C = 4.7 \times 1.13 = 5.31 \text{ ft}$$



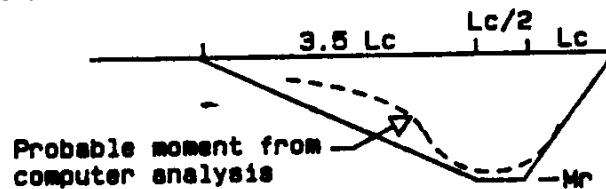
## 6.3 Moment (ref. Part II - 3.1.2)

$$M = P_p L_c + 1/2 w L_c^2$$

$$M = 1875 \times 5.31 + 1/2 \times 142 \times 5.31^2 = 12,000 \text{ ft-lb/ft}$$

$$M_r = M \times S = 12000 \times 20 = 240,000 \text{ ft-lb/rib}$$

Design moments:

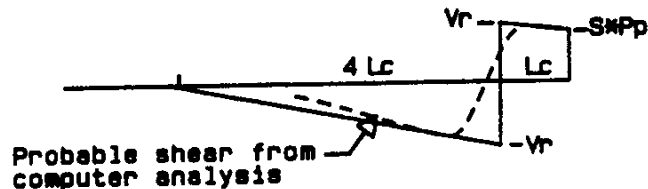


## 6.4 Shear (ref. Part II - 3.1.3)

$$V = P_p + w L_c = 1875 + 142 \times 5.31 = 2630 \text{ lb/ft}$$

$$V_r = V \times S = 2630 \times 20 = 52,600 \text{ lb/rib}$$

Design shears:



## 6.5 Reinforcing in rib (ref. Part I - 3.1.6 and 4.5)

$$A_s = (M_r / a_d) / 1.33$$

$$A_s = 240 / (1.76 \times 28 \times 1.33) = 3.66 \text{ in}^2 \text{ (top)}$$

use 3 #10 bars

$$v = V_r / b d = 52600 / (12 \times 28) = 157 \text{ psi}$$

$$v_c = (1.1 \sqrt{f'_c}) / 1.33 = 80 \text{ psi}$$

$$A_v = (v - v_c) b s / (f_s 1.33)$$

$$A_v = (157 - 80) 12 \times 12 / (24000 \times 1.33) = .35 \text{ in}^2 / \text{ft}$$

use #4 stirrups @ 12 in

## 6.6 Deflection (ref. Part II - 3.1.4)

$$\theta = M^{1.4} / 9800 I k^{.5}$$

$$\theta = 12000^{1.4} / (9800 \times 1800 \times 100^{.5}) = .0029 \text{ radians}$$

$$D = .11 + 12 L_c \theta = .11 + 12 \times 5.31 \times .0029 = .29 \text{ in}$$

$$D / 4 L_c = .29 / (4 \times 5.31 \times 12) = 1/879 \quad \text{O.K.}$$

1062

## 7. EDGE LIFT DESIGN - RIB A2/C2

## 7.1 Loads

$$w = 142 \text{ psf (same as above)}$$

$$P_p = \text{rib} + \text{wall} = 375 + 500 = 875 \text{ plf}$$

$$P_i = \text{rib} + \text{wall}^* = 375 + 700 = 1075 \text{ plf}$$

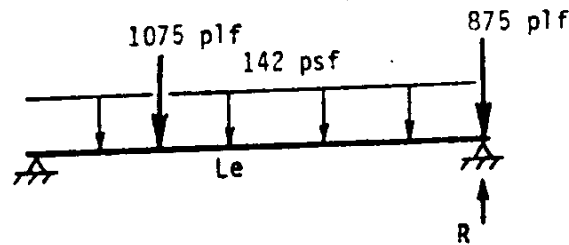
\* equivalent wall load = column load / rib spacing

$$14000 / 20 = 700 \text{ plf (ref. Appendix A - 2.4)}$$

$$L_i = 16 \text{ ft}$$



## 7.2 Equivalent simple beam (ref. Appendix A - 3.2.1)



## 7.3 Deflection (ref. Part II - 3.2.2)

$$Le = 7.5 I^{.17} Li^{.37} D^{.12} / w^{.07} Pi^{.11}$$

$$Le = 7.5 \times 1200^{.17} \times 16^{.37} \times D^{.12} / 142^{.07} \times 1075^{.11}$$

$$Le = 22.9 D^{.12}$$

assume  $D = .50$  in (somewhat less than  $Ym = 1.0$  in)

$$Le = 22.9 \times .50^{.12} = 21.1 \text{ ft}$$

$$R = Pp + 1/2 w Le + Pi(Le-Li)/Le$$

$$R = 875 + (142 \times 21.1)/2 + 1075(21.1-16.0)/21.1 = 2633 \text{ plf}$$

from heave/pressure curve (p B9), for  $D=.50$  find  $Psw=2000$

$$Lb = 1.1(R/Psw) = 1.1(2633/2000) = 1.45 \text{ ft}$$

$$D = Ym(Lm-Lb)^2/Lm^2$$

$$D = 1.0(6.0-1.45)^2/6.0^2 = .575 \text{ in} \neq .50 \text{ inch assumed!}$$

assume  $D = .54$  in

$$Le = 22.9 \times .54^{.12} = 21.3 \text{ ft}$$

$$R = Pp + 1/2 w Le + Pi(Le-Li)/Le$$

$$R = 875 + (142 \times 21.3)/2 + 1075(21.3-16.0)/21.3 = 2655 \text{ plf}$$

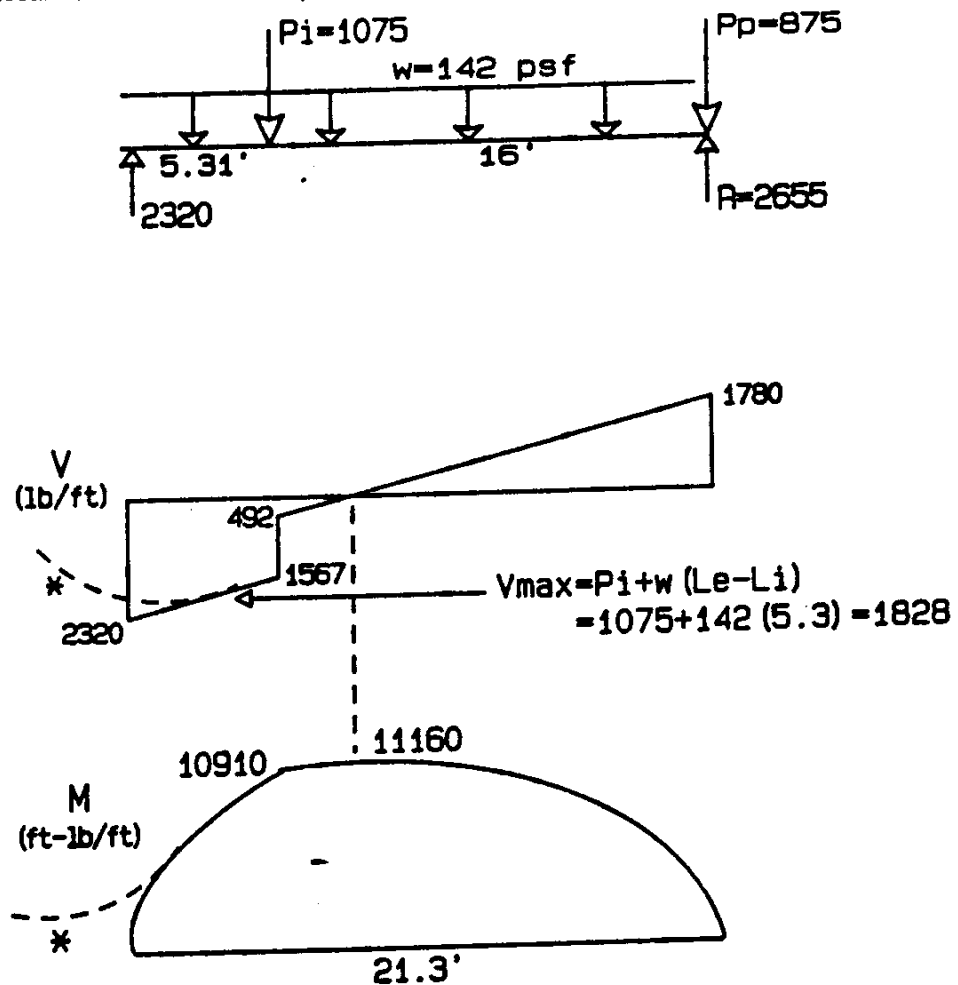
from heave/pressure curve, for  $D=.54$  find  $Psw=1800$  psf

$$Lb = 1.1(R/Psw) = 1.1(2655/1800) = 1.62 \text{ ft}$$

$$D = 1.0(6.0-1.62)^2/6.0^2 = .533 \text{ in CONVERGED!}$$

$$D/Le = .54/(21.3 \times 12) = 1/473 \text{ O.K. for non-brittle walls}$$

## 7.4 Moment and shear (ref. Part II - 3.2.3 and 3.2.4)



\* probable shear and moment from computer analysis, note that calculated  $V=2320 \text{ lb}$  will not occur, due to the effects of distributed support from the soil

## 8. EDGE LIFT DESIGN - RIB E4/C4

## 8.1 Loads

$w = 142 \text{ psf}$  (same as above)

$P_p = 1875 \text{ plf}$  (same as rib E3/C3)

$L_i = 32 \text{ ft}$  (wall along rib C1/C6)

## 8.2 Deflection

since  $L_i > L_e$  use:

$$L_e = 10.5 I^{.17} D^{.12} / w^{.07} \text{ (ref. Part II - 3.2.5)}$$

$$L_e = 10.5 \times 1200^{.17} \times D^{.12} / 142^{.07} = 24.77 D^{.12}$$

assume  $D = .48$  in

$$\text{then } L_e = 24.77 \times .48^{.12} = 22.7 \text{ ft}$$

$$R = P_p + 1/2 w L_e = 1875 + (142 \times 22.7)/2 = 3485 \text{ plf}$$

from heave/pressure curve, for  $D=.48$  find  $P_{sw}=2100$  psf

$$L_b = 1.1(R/P_{sw}) = 1.1(3485/2100) = 1.825 \text{ ft}$$

$$D = Y_m(L_m - L_b)^2 / L_m^2$$

$$D = 1.0(6.0 - 1.825)^2 / 6.0^2 = .484 \text{ inch CONVERGED!}$$

8.3 Find shears and moments by statics, similar to rib A2/C2.

## 9. CENTER LIFT DESIGN - RIB C1/C3

## 9.1 Loads

$$w = \text{slab} + LL + \text{wall}^* = 62 + 80 + 94 = 236 \text{ psf}$$

$$\begin{aligned} * \text{ wall} &= \text{wall load} / \text{rib spacing} = 1500/16 = 94 \text{ psf} \\ &\text{(ref. Appendix A - 2.4)} \end{aligned}$$

$$P_p = \text{rib} + \text{wall} = 375 + 500 = 875 \text{ plf}$$

## 9.2 Equivalent cantilever

$$L_o = 2.3 + .4 L_m = 2.3 + (.4 \times 6) = 4.7 \text{ ft}$$

$$C = .8 Y_m^{.12} I^{.16} / P_p^{.12}$$

$$C = .8 \times 1.5^{.12} \times 2250^{.16} / 875^{.12} = 1.28$$

$$L_c = L_o C = 4.7 \times 1.28 = 6.02 \text{ ft}$$

## 9.3 Moment

$$M = P_p L_c + 1/2 w L_c^2$$

$$M = 875 \times 6.02 + (236 \times 6.02^2)/2 = 9544 \text{ ft-lb/ft}$$

$$M_r = M \times S = 9544 \times 16 = 153,000 \text{ ft-lb/rib}$$

## 9.4 Shear

$$V = P_p + w L_c = 875 + (236 \times 6.02) = 2296 \text{ plf}$$

$$V_r = V \times S = 2296 \times 16 = 36,700 \text{ lb/rib}$$

## 9.5 Deflection

$$\theta = M^{1.4} / 9800 I k^{.5}$$

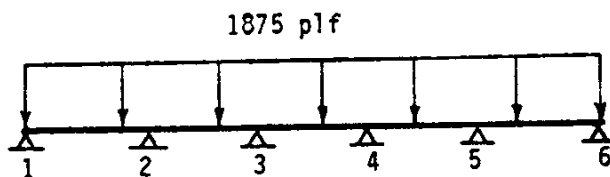
$$\theta = 9544^{1.4} / 9800 \times 2250 \times 100^{.5} = .0017 \text{ radian}$$

$$D = .11 + 12 L_c \theta = .11 + (12 \times 6.02 \times .0017) = .23 \text{ in}$$

## 10. CENTER LIFT DESIGN - PERIMETER RIB E1/E6 (ref. Part II-3.3.1)

## 10.1 Span between transverse ribs

$$P_p = 1875 \text{ plf (from calculations for rib E3/C3)}$$

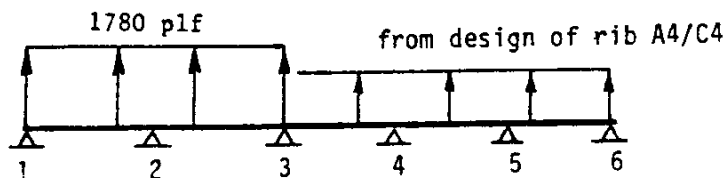


## 10.2 Analyze by conventional methods

## 11. EDGE LIFT DESIGN - PERIMETER RIB A1/A3 (ref. Part II - 3.3.2)

11.1 Span between transverse ribs for net upward force  
(from calculations on rib A2/C2)

$$R - P_p = 2655 - 875 = 1780 \text{ plf (upward)}$$



## 11.2 Analyze by conventional methods

## 12. CENTER LIFT DESIGN - DIAGONAL RIB A1/B2 (ref. Part II - 3.4)

12.1 Provide the larger shear and moment capacity of rib B1/B2 or rib A2/B2.

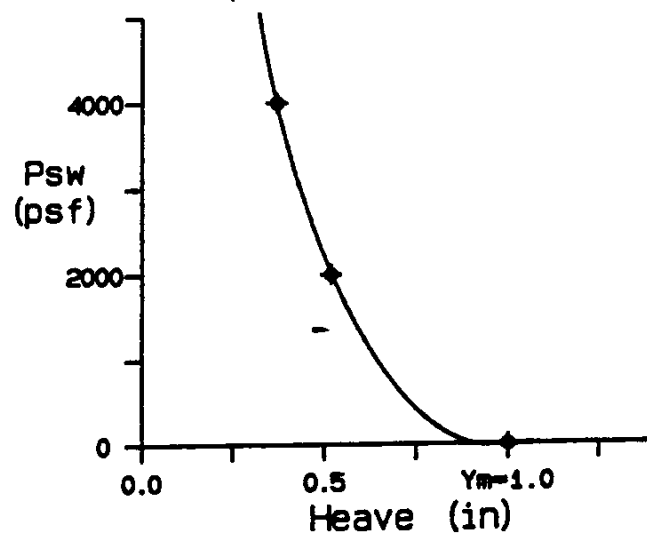
## 13. RIB D3/D4 (ref. Part I - 4.5)

13.1 Interior rib with no wall or column loads

$$A_s \geq .0033 A_g = .0033 \times 12 \times 30 = 1.20 \text{ in}^2 \text{ (top and bot.)}$$

This is the typical minimum reinforcement for the full length of all ribs.

## 14. HEAVE VERSUS SWELL PRESSURE CURVE (ref. Appendix A - 2.1)



REPLY TO  
ATTENTION OF

DEPARTMENT OF THE ARMY  
SOUTHWESTERN DIVISION, CORPS OF ENGINEERS  
1114 COMMERCE STREET  
DALLAS, TEXAS 75242-0216

16 APR 1987

SWDED-G

SUBJECT: Criteria for Developing Geotechnical Design Parameter  
for SWD Ribbed Mat Design Methodology

Commander, Albuquerque District, ATTN: SWAED-TA  
Commander, Fort Worth District, ATTN: SWFED-F  
Commander, Galveston District, ATTN: SWGED-G  
Commander, Little Rock District, ATTN: SWLED-G  
Commander, Tulsa District, ATTN: SWTED-G

1. Reference is made to criteria letter SWDED-TS/G dated 23 December 1986, subject "Design Criteria for Ribbed Mat Foundation".

2. The above reference criteria letter require certain geotechnical parameters be furnished in the Foundation Design Analysis when a ribbed mat slab foundation is recommended in expansive soil areas. Enclosure 1, for addressees only, provides guidance for development of these parameters. These procedures were developed by the Ft. Worth District with review in the Southwestern Division. Questions and/or comments should be directed to either Mr. A.L. Branch, FTS 334-2117 or Mr. Jack Fletcher, FTS 729-6365.

FOR THE COMMANDER:

Encl

*William D. Denys*  
for ARTHUR D. DENYS, P.E.  
Chief, Engineering Division

XV

7-12

40 YEARS OF SERVICE

THE SOUTHWEST

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DEVELOPMENT OF GEOTECHNICAL DESIGN  
PARAMETERS FOR RIBBED MAT FOUNDATIONS

1. REFERENCE.

1.1 SWDED-TS/G, Design Criteria for Ribbed Mat Foundations, dated 23 Dec 86.

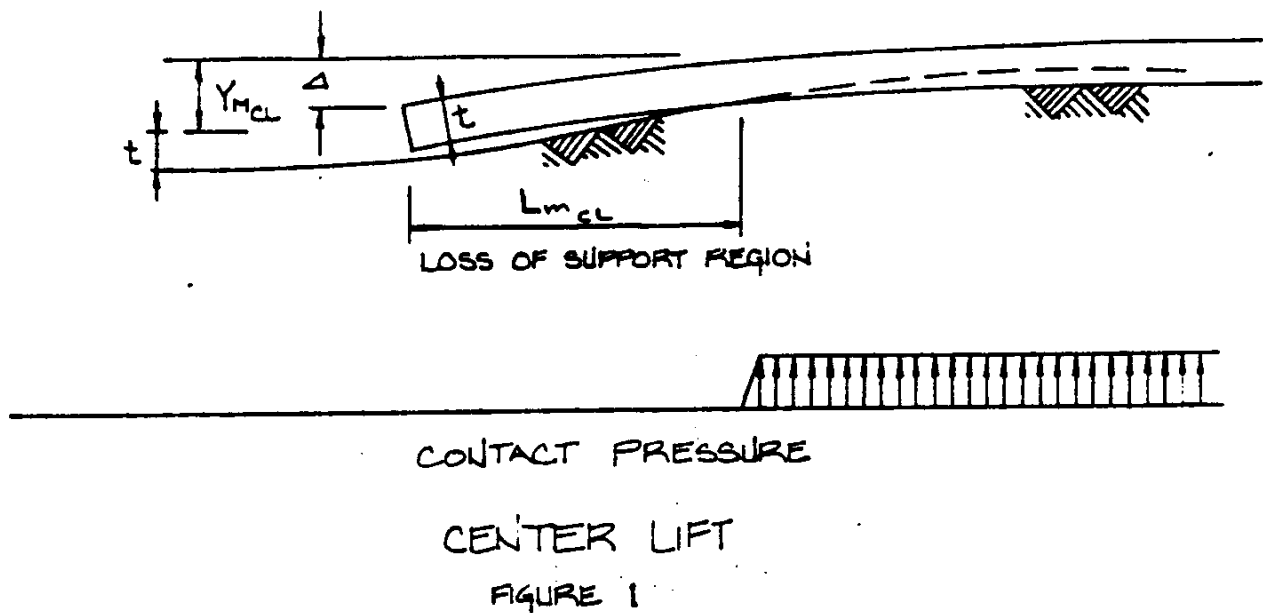
1.2 TM 5-818-7, Foundations in Expansive Soils, Corps of Engineers, 1983.

2. BACKGROUND. The recently developed structural design methodology (reference 1) models the interaction of a ribbed mat slab on an expansive subgrade for purposes of structural design. This method appears equally suited to stiffened mat systems such as flat mats, modified flat mats and inverted ribbed mats. Utilization of the methodology requires the expansion and refinement of the geotechnical design parameters furnished in the foundation design analysis. The purpose of this report is to (1) identify and (2) provide a rational method of determining these parameters.

3. SOIL-STRUCTURE INTERACTION MODES. Two heave induced deformation conditions appropriate for ribbed mat slab structural analysis are (a) center lift and (b) edge lift.

3.1 CENTER LIFT. Center lift considers doming of the foundation in the interior region of a slab on grade differentially to the perimeter region as depicted on figure 1. This may be caused either by drying of the expansive subgrade around the perimeter beam or by wetting of the dry expansive subgrade in the interior region. Perimeter drying results from (1) below average precipitation and/or (2) reduced or no landscape watering and/or

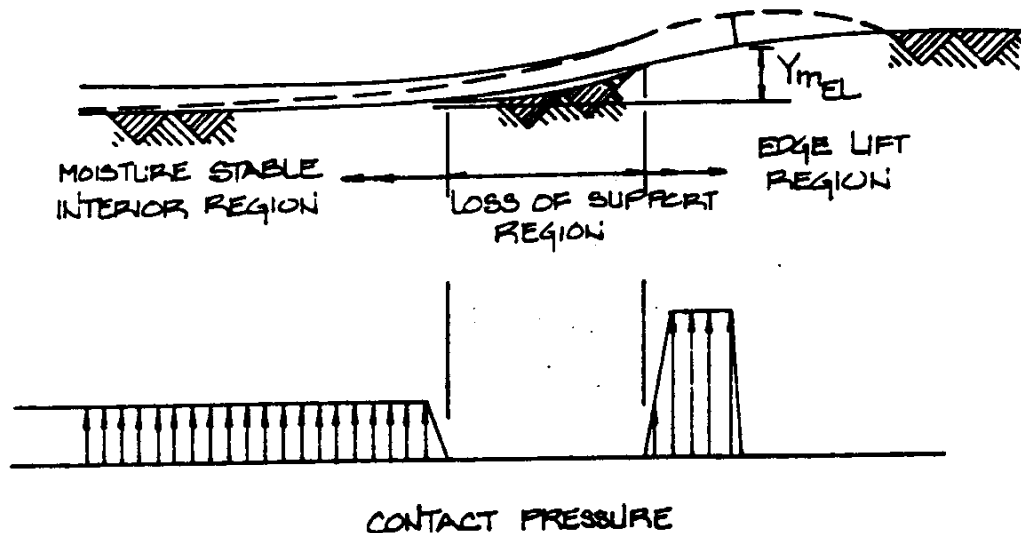




(3) removal of old paving or hard stand. Interior wetting results from (1) disruption of the site moisture equilibrium by "capping" the site with the relatively impervious slab or by removal of thick brush or trees from the site (thus eliminating evapo-transportation) and/or (2) leaky inservice or abandoned utilities. Loss of support along perimeter and first interior transverse stiffener beam results if (1) the magnitude of center lift heave is large enough and (2) the beams are sufficiently rigid to cantilever from the supported interior region.

3.2 EDGE LIFT. Edge lift involves more complex soil-structure interactions than does center lift. In edge lift, the structure is supported by heaving subgrade in the perimeter region and in the relatively moisture stable interior region. Loss of support develops when (1) the edge lift heave deformation

is large enough and (2) the spanning beam is sufficiently rigid. Edge lift mode is depicted on figure 2.



EDGE LIFT  
FIGURE 2

Soil-structure interaction within the interior supported region is reasonably represented as a beam on non-linear subgrade. Soil-structure interaction in the perimeter region is somewhat more complex because the soil deflects under the structural load as a beam on non-linear subgrade, but also the swelling soil either loads and/or deflects the beam upward. To further complicate matters, the amount of edge lift heave and the soil-beam interface pressure are interrelated and unique for each specific site. Background parameter studies for reference 1 indicate that the structural analyses are particularly sensitive

to edge lift parameters (edge lift heave magnitude and limiting beam-soil interface pressure). For example, large values for these may cause the solution to either fail to converge or indicate that the beam must be very deep and/or very heavily reinforced. While site conditions may sometimes dictate massive, very rigid stiffener beams, this is not generally the case. Generally, edge lift heave of less than 1.0 to 1.5 inches used in the design method given in reference 1 produce reasonable, constructable beams.

#### 4. DETERMINATION OF CENTER LIFT AND EDGE LIFT PARAMETERS FOR STRUCTURAL DESIGN.

4.1 CENTER LIFT - Center lift parameters to be provided in the foundation design analysis includes (1) modulus of subgrade reaction ( $K_1$ ), (2) design allowable bearing for beams ( $q_{all}$ ), (3) magnitude of center lift ( $Y_{mcl}$ ) and (4) loss of support distance around the perimeter ( $L_{mcl}$ ).

4.1.1 MODULUS OF SUBGRADE REACTION - The modulus of subgrade reaction should be taken as  $K_1 = 200 \text{ pci}$  for beams up to 12 inches wide bearing on compacted, nonexpansive fill. Higher values may be justified for granular nonexpansive fills consisting of gravel, crushed rock or limestone screenings or for cement stabilized materials if these materials extend significantly ( $D \geq 3B$ ) below the stiffener beam of width  $B$ . The foundation design analysis should direct that  $K_1$  values be factored to account for width effects such that  $K_{design} = K_1/B$ , where  $B$  is the effective beam width in feet for soil structure interaction. Note that the resultant effective beam width may include a significant width of the slab and is therefore

significantly greater than actual beam width. Studies indicate that significant load distribution occurs over an "effective" width of approximately five. It should be noted that structural design calculations are not sensitive to K value.

4.1.2 DESIGN ALLOWABLE BEARING. A design allowable bearing value ( $q_{all}$ ) has historically been assigned for sizing of stiffener beams, perimeter beams and enlarged beam intersections beneath columns. Values are typically given considering the beam to be a continuous strip footing or the beam intersection to be a spot footing (carrying either line or concentrated loads, respectively). The allowable bearing value is typically developed based on the average strength of engineered fill at shallow depth with a factor of safety of not less than 3.0. Design loads typically include full dead load plus half live load. The purpose in sizing the beams and beam intersections for this design allowable is to provide uniform contact pressures at the beam-soil interface therefore limiting inservice differential settlement. The assumptions of minimal load sharing between the slab and beams, ample safety factor on the fill strength, and minimum beam widths specified in the SWD EIM combine to limit the mobilized soil strains to low levels. This leads to very small structurally induced deflections given uniform, nominal fill depths. Actual values assigned for design bearing allowables have seldom exceeded  $q_{all} = 2.0$  KSF although values as high as 3.0 KSF have been assigned in limited cases where required and justifiable. Seldom are there structural requirements for larger allowables bearing values since specified minimum beam widths generally govern.

4.1.3 MAGNITUDE OF CENTER LIFT HEAVE POTENTIAL. - The magnitude of center lift heave potential ( $Y_{mcl}$ ) given in the foundation design analysis should be the residual heave potential at the site. The value of  $Y_{mcl}$  should include effects due to subgrade removal and replacement criteria, any surcharge effects due to fill above original subgrade and the weight of the proposed structure. Maximum design value for center lift potential should not exceed 1.5 inches. Where attainable with reasonable removal/replacement depths ( $\leq 36$  inches), it is desirable to limit  $Y_{mcl}$  to not more than 1.0 inch, which is well within the "tolerable" inservice deformation range of most structures. Minimum remove/replace depth should be taken to the bottom elevation of the ribbed mat slab beams.

function  
of  
Anticipated  
Loads

The heave potential is determined by three soil parameters: the coefficient of swell ( $C_s$ ), depth of active zone ( $X_a$ ) and expansion pressure ( $P_{exp}$ ).

Caution should be used in selecting coefficient of swell ( $C_s$ ) values for heave analyses since swell pressure test results significantly underestimate  $C_s$  values compared to controlled expansion-consolidation-rebound tests. Additionally, both test methods tend to give low  $C_s$  values since most rebound time curves are terminated well before primary swell is completed.

★ An appropriate design value of the depth of the active zone ( $X_a$ ) typically lies between the present depth to the stable relative moisture content (estimated by observing the relationship of moisture content to the plastic limit) and the maximum depth observed, such as the maximum depth of weathering. Typical  $X_a$  values for the central and north Texas regions and

central Oklahoma region appear to vary from about 10 to 15 feet. These values have been estimated for (1) regression heave analyses for distressed structures and (2) depth of moisture variation versus approximate return/duration interval studies. Values smaller than 14 feet may be applicable in specific cases such as where the active zone is the distance between the structural foundation element or slab on grade and a perched water table; a condition common in these regions.

Center lift heave analyses should consider "saturated" conditions to a depth of  $X_a$ . If a nominal remove/replace depth and saturated subgrade assumptions indicate unreasonable residual heave potential, consider increasing the depth of remove/replace and/or recommending a more defensive design to prevent saturation of the subgrade.

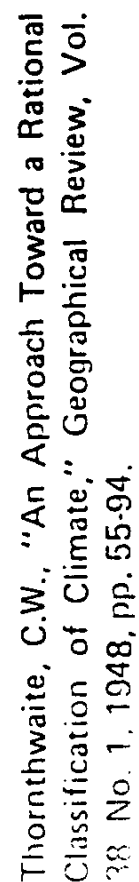
Expansion pressures should be developed versus depth using small depth intervals. These should be developed from laboratory data for the site. Additionally, these may be supplemented using proper correlations with nearby, preferably adjacent sites.

4.1.4 EDGE MOISTURE VARIATION DISTANCE. The edge moisture variation distance ( $L_{mcl}$ ) may control the design of interior stiffener beams which are adjacent to the perimeter. The maximum moments and shear are induced in the transverse beams when these elements cantilever free of foundation support from the interior supported region to the outside of the perimeter beam. The length of cantilver is largely controlled by the value of  $L_{mcl}$ . SWD adopted this concept from Post-Tensioning Institute (PTI) guidelines, originally developed for lightly loaded flexible mats in the late 1970's and early 1980's. Standard practice in the

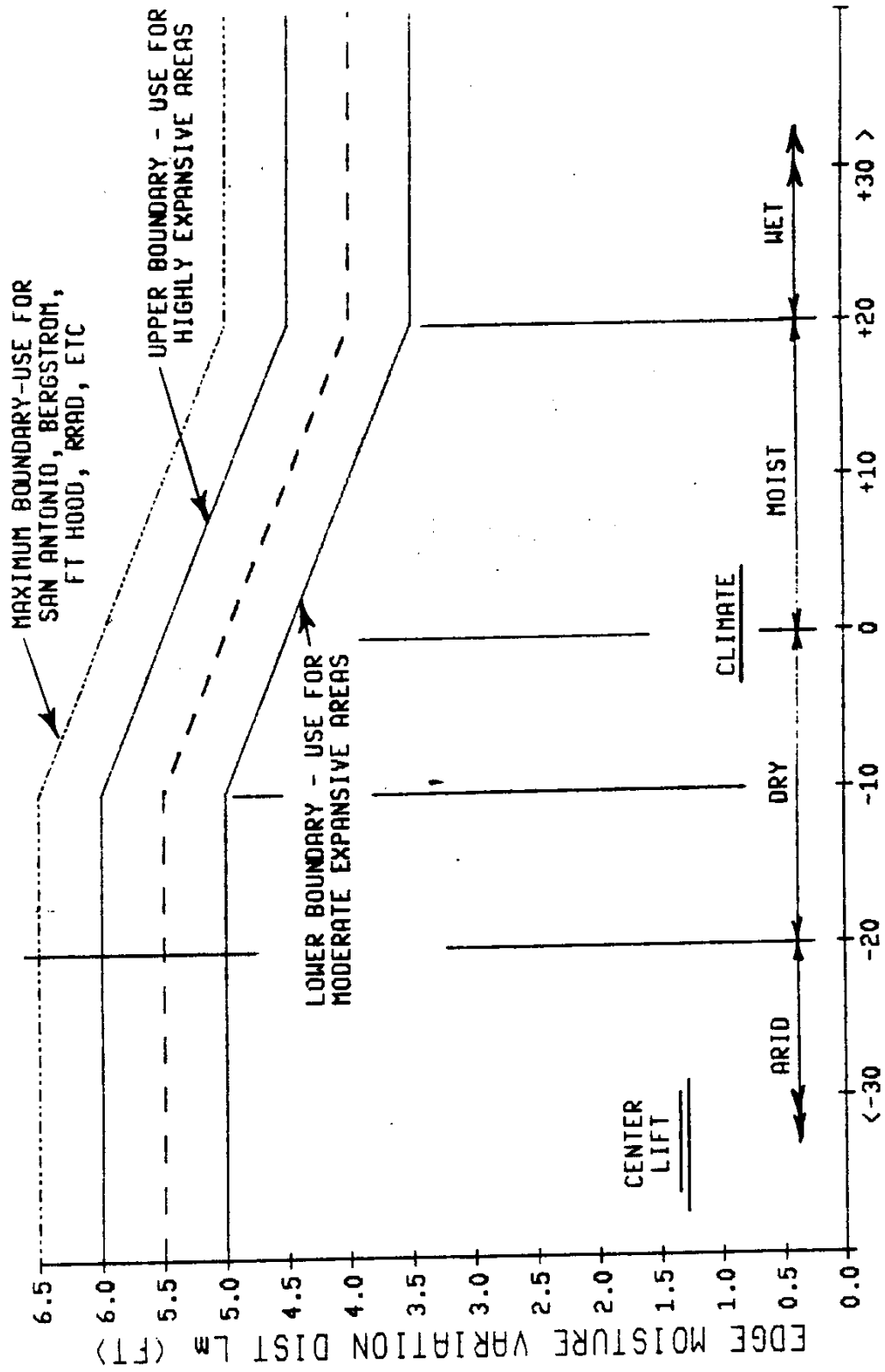
San Antonio area has been to assign upper or near upper bound values from TMI for design  $L_{mcl}$  values. At least two aspects of designs probably tend to moderate the actual edge moisture variation distance experienced; these being (1) relatively deep perimeter beams which act as a physical barrier and (2) the non-expansive fill blanket which tends to make changes in moisture content (and therefore any resultant heave or shrinkage) more uniform and provide a surcharge effect as well. Other factors, however, tend to offset these moderating effects. These include very short return interval of edge moisture variation events presented in TMI (reported by some sources to range from 1 to 2 years). Typical project design life of projects exceeds 20 or 30 years and, since we're still using many World War II facilities, it may well exceed 50 years. Estimated edge moisture variation values considering a 100 percent probability of experiencing a 20 to 30-year return interval event may well be twice typical TMI values.

Based on a subjective combination of all factors, it is suggested that  $L_{mcl}$  be taken as the edge moisture variation distance determined using figures 3 and 4. These values should be modified, either up or down, based on site specific soils investigations and engineering judgement.

4.2 EDGE LIFT - Edge lift parameters to be provided in the foundation design analysis include (1) modulus of subgrade reaction ( $K_1$ ), (2) magnitude of edge lift heave ( $Y_{mcl}$ ), (3) limiting soil-beam interface pressure ( $P_{sw}$ ) for that portion of the beam being acted on by the heaving subgrade and (4) a value for edge moisture variation distance ( $L_{mcl}$ ).







APPROXIMATE RELATIONSHIP BETWEEN THORNTHWAITE INDEX AND MOISTURE VARIATION DISTANCE

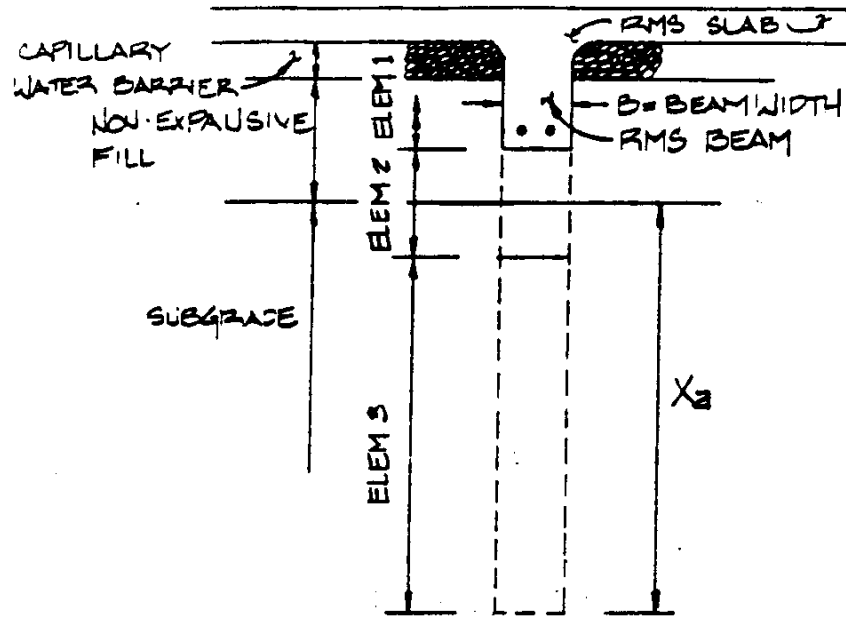
FIGURE 4

4.2.1 MODULUS OF SUBGRADE REACTION. - Values given for center lift are considered appropriate for edge lift also.  $K_1 = 200 \text{ pci}$

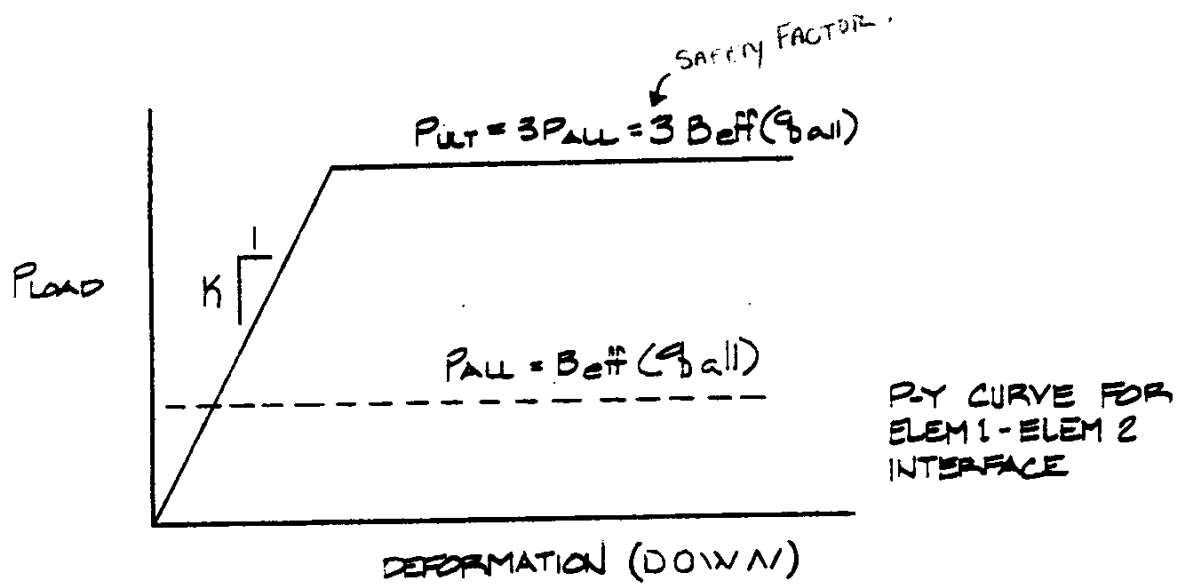
4.2.2 SOIL-BEAM INTERFACE PRESSURE. Discussion of both limiting soil-beam interface pressure and magnitude of edge lift heave parameters ( $P_{sw}$  and  $Y_{mL}$ ) are best handled concurrently since both are intimately related and the analysis necessary for solution determines both simultaneously.

The area of soil-beam contact in the swelling perimeter region involves a somewhat complex soil-structure interaction situation. As edge lift develops and loss of support occurs between the perimeter and interior regions, the heaving soil may well exert a pressure on the stiffener beams well in excess of typical design interface pressures ( $q_{all}$ ). As the soil column swells and lifts the overlying beam, the soil-beam contact area increases toward the interior region to accommodate the greater structural reaction.

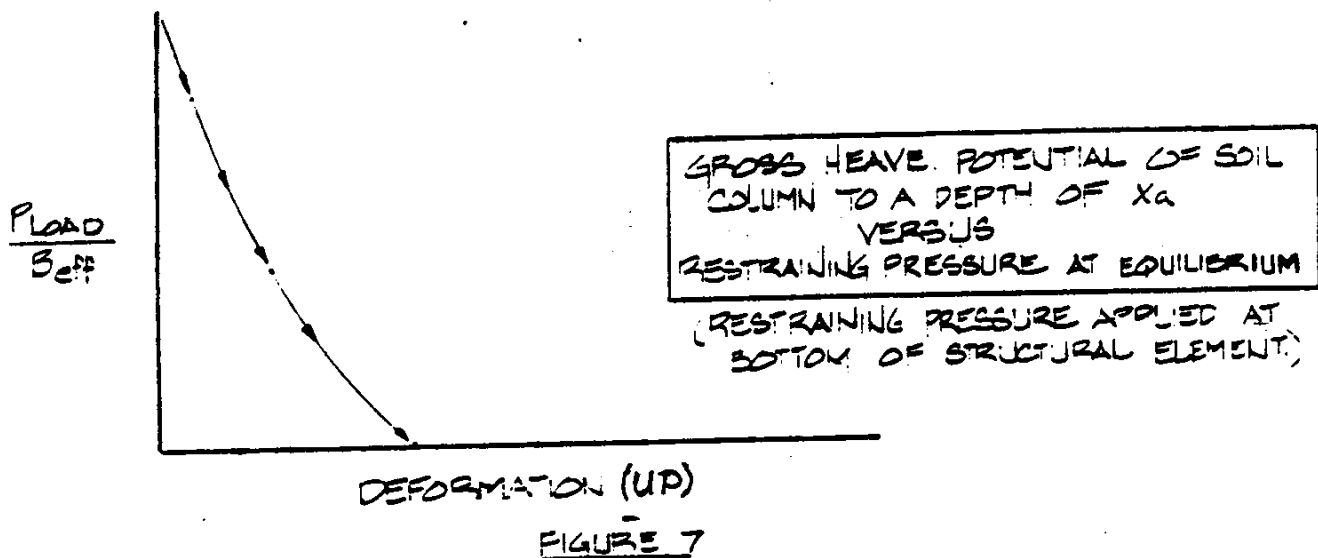
The soil-structure interaction in the edge lift region can be visualized as a three-component system; (1) a structural element (a beam or mat strip), (2) an element of nonexpansive fill beneath the structural element plus that piece of the expansive subgrade restrained against heave by the weight of the overlying fill and the stresses induced beneath the structural element, and (3) the heaving column of soil to a depth of  $X_a$  beneath the bottom of the nonexpansive fill blanket (figure 5).

FIGURE 3

The load-deformation relationship of element 1 interacting with element 2 can be represented by a P-Y curve shown in figure 6.

FIGURE 6

The load-deformation relationship of element 3 interacting with elements 1 and 2 in the column immediately below the beam as shown on figure 7. The plot consists of the net heave potential of the swelling soil column versus those forces resisting the tendency to swell, taken at the base of the structural beam.



These relationships can be added algebraically to produce a composite p-y curve which can be easily utilized by available soil-structure interaction programs for structural analysis. Since such analysis is within the purview of the structural engineer, the geotechnical engineer need only furnish the pressure heave relationship in useable form in the Foundation Design Analysis. It is suggested that this information be provided in a tabulated format giving coordinates for at least three points. These minimum three points should be the  $P_{sw}$  and  $Y_{mbl}$  coordinates for (1) pressure equal to  $P_{ult}$ , (2) pressure equal to  $P_{all}$  and (3) pressure equal to zero.

$P_{ult} = F.S. \times P_{allow}$

4.2.3 EDGE MOISTURE VARIATION DISTANCE. Edge moisture variation distance ( $L_{m\&L}$ ) appropriate for edge lift analysis may be taken from the TMI chart given in figure 8.

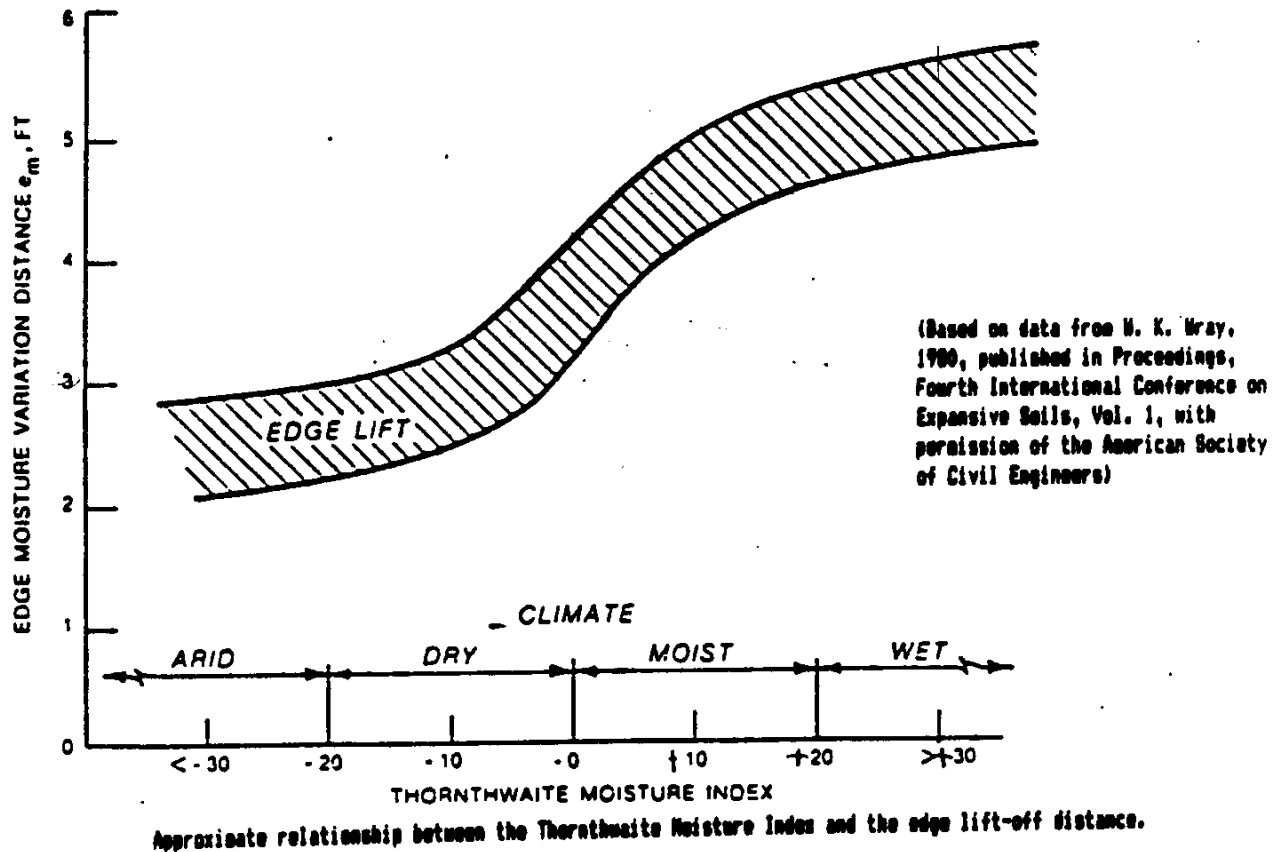


FIGURE 8

The TMI values represent approximate environmentally induced events. As a result, upper bound values should be selected for design. It is recommended, however, that average values be used for all SWD projects. Additionally, recommendations should be made in the foundation design analysis to limit the potential for developing "hot spots" due to long term sources of free water around the building perimeter.

*function of the type of bldg, ie, Back Street or Not*

4.3 Certain structure-site situations may well warrant deleting edge lift analyses as follows:

4.3.1 Where the proposed structure is a pre-engineered metal building without interior masonry walls or heavy interior dead or permanent live loads.

4.3.2 Where defensive design efforts have been incorporated and reasonable confidence exists that these will be constructed and maintained as intended.

4.3.3 Where minor architectural distress (such as cracking of masonry walls, plaster walls, tiled surfaces) is not likely to cause undue user concern or raise inservice maintenance requirements significantly.

## 5. APPENDIX A

5.1 EXAMPLE PROBLEM. An example problem is provided in Appendix A.

**APPENDIX A**

**EXAMPLE PROBLEM**

1. **Required.** - Develop geotechnical parameters for the structural design of a ribbed mat slab given the following:

a. **Proposed Structure.** - Office/Administration type structure located in San Antonio, Texas, 60X150 feet in plan. The structure is to consist of double wythe masonry (face brick over CMU) load bearing exterior walls and isolated interior columns at 20 ft. centers.

b. **Proposed Site.** - One acre, minimal topographic relief, site covered with mesquite trees.

c. **Subsurface Conditions.** - Drilling program (5 borings) indicates the foundation materials consist of (1) a surface stratum of high plasticity clay grading into medium plasticity clay with depth to a total thickness of 14 feet, (2) a water bearing sand and gravel stratum from 1 to 7 feet thick overlying, (3) an expansive clay shale formation.

d. **Summary Laboratory Test Data.** -

Stratum	Depth (ft)	USCS	$\bar{W}_o$ (%)	$\alpha$ (pcf)	LL	PI	$P_{exp}$ (tsf) (net)	$C_s$	$C_c$	$C_u$ (ts)
1	0-4	CH	25	105	65	45	0.8 -1.0	0.06	0.02	0.
2	4-14	CL	14	108	44	30	0.6	0.06	0.18	0.
3	14-20	GC	6	-	25	12	0	-	-	50 B/
4	20 plus	Wea. Clay Shale	22	110	70	52	2.0	0.09	0.22	1.



## 2. Determine Parameters Required for Center Lift Analysis:

a. Modulus of Subgrade Reaction ( $K_1$ ). - Mat slab will be founded on nonexpansive fill, therefore it is reasonable to assign a value of  $K_1 = 200$  PCI. The structural engineer should factor this value based on effective beam width such that  $K_{design} = K_1 (1ft/B_{eff}, ft)$ .

b. Design Bearing Allowable ( $q_{all}$ ). - Since beams will be supported on nonexpansive fill and the building loads will range from light to moderate, it appears that a design bearing allowable of  $q_{all} = 2.0$  KSF is appropriate.

c. Magnitude of Center Lift Heave Potential ( $Y_{acl}$ ). -

(a) Calculate site heave potential

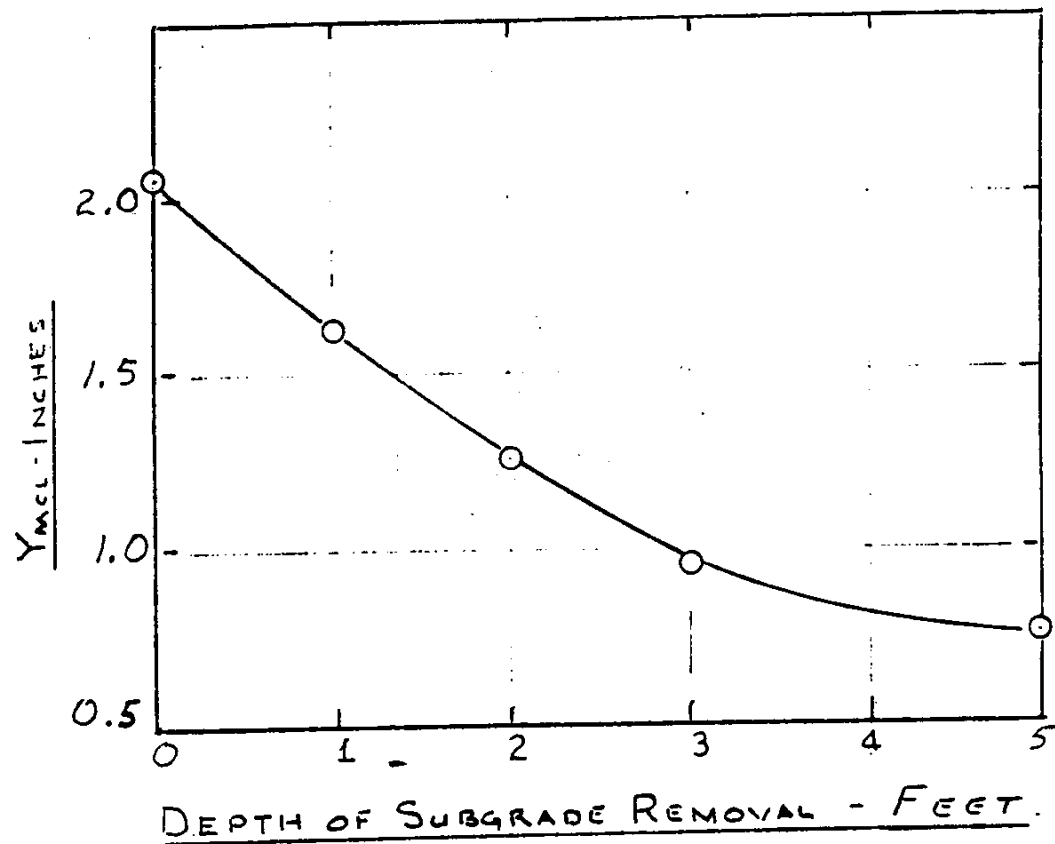
Given:  $C_s = 0.06$ ,  $e_o = 0.60$ ,  $P_o$  = effective overburden pressure,  $P_{exp}$  = gross swell pressure,  $P_r$  = effective pressure resisting heave beneath mat including  $P_o$ , {surcharge due to fill and structural dead load,  $h_u$  = heave for soil layer  $h$  inches thick, and an  $X_a = 10$  feet.

$$C_s = .06$$

$$e_0 = .60$$

z (ft)	z (ft)	P <sub>o</sub> (tsf)	P <sub>exp</sub> (tsf)	P <sub>r</sub> (tsf)	h (in)	$h_r = \frac{C_{sh}}{1 + e_0} \log_{10} \frac{P_{exp}}{P_r}$ (inches)	$h_r$ (bottom to top) (inches)
0-1	0.5	0.03	1.0	$\frac{.07 + .03}{.07 + .1}$ 0.1	12	0.45	2.07
1-2	1.5	0.1	1.0	0.17	12	0.35	1.62
2-3	2.5	0.17	1.1	$\frac{.07 + .17}{.07 + .17}$ 0.24	12	0.30	1.27
3-4	3.5	0.23	0.8	0.3	12	0.19	0.97
4-6	5	0.33	0.9	0.4	24	0.31	0.78
6-8	7	0.46	1.0	0.53	24	0.25	0.47
8-10	9	0.6	1.2	0.67	24	0.22	0.22
10-12	11	0.73	1.35	0.8	24	0.2	N/A
12-14	13	0.86	0.9	0.93	24	N/A	N/A

Determine required depth of subgrade replacement and residual heave potential after replacement with nonexpansive fill. A plot of replacement depth versus residual heave taken from the above table follows:



Removal and replacement to 3.0 feet will reduce the heave potential to approximately 1.0 inch, thus  $Y_{mcl} = 1.0$  inch. Note that significant additional removal would be required to reduce the residual heave potential any significant additional amount.

d. Edge Moisture Variation Distance ( $L_{mc1}$ ) - taken from figures 3 and 4 as  $L_{mc1} = 6.5$  feet.

3. Determine parameters required for Edge Lift analyses:

a. Modulus of Subgrade Reaction ( $K_1$ ). - Same as for Center Lift.

b. Design Allowable Bearing ( $q_{all}$ ). - Same as for Center Lift.

c. Soil - Beam Interface Pressure ( $P_{sw}$ ) and Magnitude of Edge Lift Heave Potential ( $Y_{me1}$ ). -

Determine the residual heave potential for the soil column beneath a typical beam for a range of assumed interface pressures.

A summary of calculations and results is presented in tabulated form on page 6. A plot of soil-beam interface pressure versus heave potential is shown on page 7. A reasonable bilinear representation of the results, for use by the structural engineer, can be developed assuming a linear relationship between the following points:

<u><math>P_{sw}</math>, TSF</u>	<u><math>Y_{me1}</math>, Inches</u>
0.0	$Y_{me1} = 1.25$
$q_{all} = 1.00$	$Y_{me1} = 1.0$
$q_{ult} = 3(q_{all}) = 3.00$	$Y_{me1} = 0.6$

d. Edge Moisture Variation Distance ( $L_{me1}$ ). The edge moisture variation distance is taken from figure 8 as  $L_{me1} = 3.0$  feet.

Given:  $D_f = 2.0\text{ft}$   $B = 1.0\text{ft}$

$C_s = 0.06$   $e_o = 0.60$

$\gamma_m = 125\text{pcf}$

$\sqrt{0.5\text{tsf}}$																	1.0tsf				2.0tsf				4.0tsf			
Z ft	$\bar{z}$ ft	h in	$\frac{\bar{z}-D_f}{B}$	$I_s$	$P_o$ tsf	$P_o+P_s$ tsf	$P_{exp}$ tsf	$\Delta P$ tsf	$P_f$ tsf	$\Delta h_f$ in	$\Delta P$ tsf	$P_f$ tsf	$\Delta h_f$ in	$\Delta P$ tsf	$P_f$ tsf	$\Delta h_f$ in	$\Delta P$ tsf	$P_f$ tsf	$\Delta h_f$ in									
0-3	<																											
---COMPACTED NONEXPANSIVE FILL TO A DEPTH OF 3.0 FT.---																												
3-4	3.5	12	1.5B	0.28	0.23	0.30	0.8	0.14	0.37	0.15	0.28	0.51	0.08	0.56	0.79	0	1.12	1.35	0									
4-6	5.0	24	3.0B	0.15	0.33	0.40	0.9	0.07	0.40	0.32	0.15	0.48	0.25	0.30	0.63	0.14	0.60	0.93	0									
6-8	7.0	24	5.0B	0.09	0.46	0.53	1.0	0.05	0.53	0.25	0.09	0.55	0.23	0.18	0.64	0.17	0.36	0.82	0.09									
8-10	9.0	24	7.0B	0.07	0.60	0.67	1.2	0.04	0.67	0.23	0.07	0.67	0.23	0.14	0.74	0.19	0.28	0.88	0.12									
10-12	11.0	24	9.0B	0.05	0.73	0.80	1.35	0.03	0.80	0.20	0.05	0.80	0.20	0.1	0.83	0.2	0.20	0.93	0.16									
12-14	13.0	24	11.0B	0.04	0.83	0.90	0.9	0.02	0.90	0.0	0.04	0.90	0.0	0.08	0.91	0	0.16	0.99	0									
									$\Sigma \Delta h_f = 1.15$				$\Sigma \Delta h_f = 0.99$				$\Sigma \Delta h_f = 0.7$				$\Sigma \Delta h_f = 0.38$							

Where:

$Z$  = depth interval

$\bar{z}$  = mean depth

$B$  = beam width

$D_f$  = beam depth

$\gamma_m$  = stress with depth

$P_o$  = overburden pressure

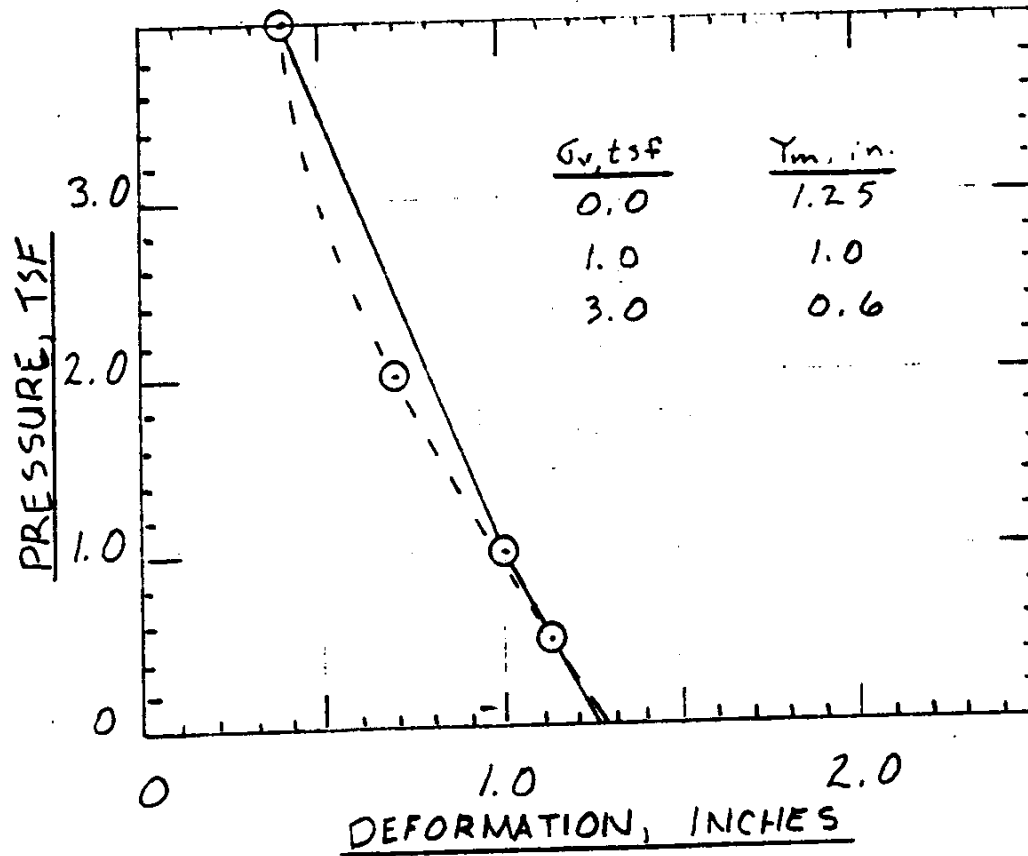
$P_s$  = surcharge pressure  
next to beam

$P_{exp}$  = expansion pressure

$P_f$  = vertical pressure resisting  
heave below beam

$P$  = stress @ depth due to  
to  $q_{app}$   $\Delta P = (I_s)(q_{app})$

$P_f = \begin{cases} \Delta P + P_o & \text{whichever is} \\ \text{or} & \\ P_o + P_s & \text{greater} \end{cases}$



EDGE LIFT PARAMETER

EXAMPLE PROBLEM

**APPENDIX B****LIST OF DRAWINGS****1. APPENDIX J – DRAWINGS**

<b>SHEET NUMBER</b>	<b>DESCRIPTION</b>
G301	PROJECT LOCATION MAP I
G302	PROJECT LOCATION MAP II
G303	PROJECT LOCATION MAP III
C001	SITE DEVELOPMENT PLAN (EXISTING CONDITIONS)
C002	SITE DEVELOPMENT PLAN (EXISTING CONDITIONS)
C003	SITE DEVELOPMENT PLAN (EXISTING CONDITIONS)
C101	SITE DEVELOPMENT PLAN (APPROXIMATE CHAPEL COMPLEX SITE LIMITS)
C102	SITE DEVELOPMENT PLAN (CONCEPTUAL LAYOUT PLAN)
C103	SITE DEVELOPMENT PLAN WITH FUTURE CDC (CONCEPTUAL LAYOUT PLAN)
C104	SITE DEVELOPMENT PLAN FUTURE CDC PARKING LOT (CONCEPTUAL LAYOUT PLAN)
C105	SITE DEVELOPMENT PLAN FORCE PROTECTION SETBACKS (CONCEPTUAL LAYOUT PLAN)
C106	ENVIRONMENTAL 50-FOOT SETBACK
C501	AREA DEVELOPMENT PLAN (CONCEPTUAL UTILITY PLAN)
C901	SWING GATE DETAIL
A101	CHAPEL FAMILY LIFE CENTER FLOOR PLAN
A102	MPAC FIRST FLOOR PLAN
A103	MPAC SECOND FLOOR PLAN
A104	COMBINATION FIRST FLOOR PLAN
ES101	ELECTRICAL EXTERIOR PLAN
ES102	EXTERIOR COMMUNICATION PLAN

**2. CADD FILES AND CADD FILES ORIGINAL SURVEY:**

The CADD survey files and other electronic CADD files as identified below have been included via the CADD-Files.zip file provided. The Government provided survey, and the other electronic CADD files are provided to assist the Contractor in preparing their proposal using their own commercially purchased estimating software. The Contractor shall take all professionally prudent and reasonable actions to verify the accuracy of the data provided and shall assume all liability from the use of these files. The Contractor shall be responsible for obtaining any other software necessary to view the files provided. No other CADD design files will be provided for proposal preparation. CADD files (.dgn format) require Microstation V8 software.

**FLOOR-PLANS**

Chapel Family Life Center Floor Plan  
Multi-Purpose Activity Center Floor Plan

**SURVEY-DATA**

Survey data (excluding breaklines and survey points, and move to elevation of zero)

**APPENDIX C**

**Utility Connections**

Utility connections are shown on the drawings provided in Appendix J.



**APPENDIX D**

**Fire Flow Tests**

**Hydrant locations for these readings are shown on the drawings in Appendix J.**

**READ HYDRANT**

Static Pressure: **64 psig**

Residual Pressure: **54 psig**

**FLOW HYDRANT**

Coefficient: **.90**

PITOT Pressure: **37 psig (Approximately 1025 gpm)**

## **APPENDIX E**

### **Environmental Information**

Provide a clear distance of 50 feet from the edge of the concrete lined drainage ditch at the eastern portion of the site to any constructed features.

## Appendix F: Architectural Considerations

The two buildings in this solicitation are part of a new campus of buildings the Government is building at Fort Hood, Texas over several years and different appropriations. The four buildings are:

Building	Size	Project Number	Design-Build Construction Contract	General Contractor/A-E Partner.
Chapel Complex	32,900 GSF	PN 025033	W9128F-09-C-0021	Solis Constructor's, Inc./GS&C Architecture & Interior Design
Religious Education Facility	9,525 GSF	PN 025033	W9128F-09-C-0021	Solis Constructor's, Inc./GS&C Architecture & Interior Design
Family Life Center	17,000 GSF	PN 071515	[this solicitation]	[winning offeror]
Non-standard design Multi-Purpose Activity Center	10,000 GSF	PN 071515	[this solicitation]	[winning offeror]

Appendix F contains excerpts of the drawings, renderings, and design analysis showing the architectural theme of the buildings currently under construction under Contract Number W9128F-09-C-0021. This appendix does not contain work covered under contract. The Government provides these data to aid offerors in preparing a proposal that will meet the Government's requirements for architectural theme. Appendix F is not intended to limit design, manufacturer and/or material selections. In cases of conflict between this appendix and the rest of the solicitation, the rest of the solicitation governs.

### Contents:

Excerpt from the Architectural Design Narrative.

Digital Rendering of the Chapel and Religious Education Facility

Perspective Drawings (4) of the Chapel and Religious Education Facility

Architectural Drawings

A-120. Interior Finish Plan – Chapel

A-121. Interior Finish Plan – REF

A-201. Exterior Elevations

A-202. Exterior Elevations

A-203. Exterior Elevations

A-204. Exterior Elevations

A-301. Building Sections.

A-302. Building Sections.

A-303. Building Sections.

## ARCHITECTURAL DESIGN NARRATIVE:

### *Architectural Theme and Materials.*

The aesthetic theme for this facility is centered on the Army's need for new worship facilities at Fort Hood that are efficient, economical and attractive, with the primary goal of supporting the worship services of all distinctive faith groups at Fort Hood. These goals are achieved through material and color selection in many ways.

In beginning our study of finishes for this project, it was important to note that this is a multi-building campus and as such we determined to relate each of the buildings' finishes to each other; both interior and exterior. Both buildings share many of the same finish elements in so much as possible and if appropriate for a specific application. There are (7) distinct program areas that are either common between buildings or have a major program space represented in each: Worship, Assembly & Activity, Classroom & Multi-Purpose, Administration, Children's Area, Kitchen & Pantry, and, Circulation & Restrooms. The proposed finishes have been selected with these program areas in mind; each space will have its own identity while at the same time all spaces are tied back to a common architectural theme of finishes.

The facility aesthetics help to improve the working conditions for the soldier populations that will utilize the facility by the application of appropriate and responsible design decisions, coupled with careful material selections. The materials and textures proposed in these arrangements are appropriate for their usage. This is of utmost importance because the materials will be experienced by the soldier population through the course of their stay and will have an effect on them. Designing a facility that addresses the human perceptions of space, comfort and atmosphere are foremost in our mind as responsible designers.

### **Interior Finish Materials**

The finishes represented in the accompanying Interior Design Finish Binders represents a majority of finishes represented in each space described above. All materials have been selected with our goal of LEED Silver certification in mind and embody excellent sustainable design characteristics.

Several different carpet tile patterns are indicated, all from the same manufacturer. Darker colors with broad patterns, best for use in larger areas, are proposed for the Worship Area. High-use carpet which stands up well to heavy foot traffic has been selected for use in the circulation areas. More subtle patterns with neutral tones have been selected for Administration areas. Classrooms receive carpet with patterns and color intended to promote learning; low contrast colors and pattern. Porcelain floor tile has been selected for high-use areas where various events can occur which could result in damage or stain to carpet, such as food service. These are high use assembly areas similar in function to a school cafeteria or common area. Tile shall have non-slip characteristics. Porcelain floor tile is also used within restrooms and shall have coordinating tile wall base. Vinyl composition tile is to be used in minor Corridors, Storage Areas and Janitor Closets. Color is neutral and selected to coordinate with and transition gently from adjacent floor materials. Several different colors of rubber wall base are selected, each intended to coordinate with and compliment adjacent floor and wall materials.

Main 'field' paint color is an off-white color with very little beige. Other wall paint colors are selected as accent colors and are used to identify important changes in use or to accentuate a sense of increased depth in select areas. All gypsum board ceilings will be painted with common ceiling paint color, very similar to but lighter than the common 'field' wall paint color. This is the only paint color proposed for this ceiling type. Porcelain wall tile is provided mainly in restrooms as a tile wainscot. Wall tile colors selected are intend to alternate in a random pattern, all within a similar color range to compliment the floor tile and wall paint color. Acoustic wall panels are provided on the high wall opposite the Worship

Center Raised Platform (bulkhead containing the supports and mechanisms for the proposed Operable Partitions). These panels will act to reduce acoustical reverberation issues within this space. Colors will be neutral and slightly darker than the wall paint color to provide an architectural, repetitive feature within the space.

All areas identified to have an acoustic tile ceiling will utilize a high-performance mineral fiber acoustic panel, intended to limit acoustic reverberation issues in large areas as well as smaller rooms. This material is proposed throughout the facility and is presented as a betterment to the Government.

Wood trim is utilized throughout the facility. A honey wood finish has been selected as to not appear too heavy or imposing. The wood species and stain color have been selected to compliment the material installed adjacent to it.

### **Exterior Finish Materials**

The RFP and Ft. Hood Installation Design Guide (FH-IDG) identify the project site as being within the Ft. Hood “Community Core” visual zone, which has a select group of finish recommendations available for use in new construction. The following table provides a comparison of required elements per the RFP/Amendments/FH-IDG to the finishes we propose for this project. Exterior finishes are common between both the Chapel Complex & Religious Education Facility. All openings will be designed to meet applicable AT/FP requirements.

EXTERIOR FINISH ELEMENT	REQUIRED (Per RFP /Amendments& FH-IDG)	PROPOSED (Per proposal section 5.3.2.3)
<b>Walls:</b>		
Primary material:	Color to match Pantone I3-1009 TPX Indigenous Texas Limestone, earth- neutral tones	Color to match Pantone I3-1009 TPX Indigenous Texas Limestone, earth- neutral tones
Secondary Material:	Stucco, Split faced masonry, light brown, natural.	Stucco at gable ends of entry canopies (both buildings) and at dormers on R.E.F. building.
Building detail/Embellishments:	Transition material/lintels, light brown, natural.	Natural cast-stone lintel, banding & Sills
<b>Roof:</b>		
Pitch	4:12	4:12
Material	Color to match Pantone	Pre-finished 16” standing seam metal roofing on protection board over rigid insulation “MBCI Signature 300 “ Tundra Kynar 500”. Proposed color meets LEED criteria for solar reflectance.
Soffit	Metal, white.	Pre-finished metal soffit panels, white.
Trim (gutters, down spouts, rake)	Metal, Color to match the roof	Pre-finished metal to match roofing, “MBCI Signature 300 “ Tundra Kynar 500”.

**Fenestration:**

Entrance doors	Full glass pane, double doors with window lite each side, recessed.	Full glass, recessed storefront double doors with lites each side.
Door frames and detail	2" metal frame	Aluminum storefront at main building entries or welded & painted hollow metal at others.
Secondary entrance doors	Metal, hollow core with 2" frame, recessed.	2" welded & painted hollow metal. Recessed per plans provided.
Window treatment	Recessed windows, consistent repetition throughout.	Recessed and consistent repetition per plans provided.
Window frame and detail	2" metal frame.	2" anodized aluminum frame.

Aesthetics

Finishes throughout the facility have been preliminarily studied and selected by experienced licensed Interior Design professionals who are accustomed in selecting finishes within specific use categories. Finishes proposed with this RFP response have been selected with this in mind; appearance, tactile perception, color perception and appropriateness of use with a connection to an overall aesthetic scheme.

The color scheme throughout the facility will consist mainly of color combinations often found occurring naturally outside of the built environment. These pleasant, unobtrusive color combinations are especially appropriate for this environment, where other color combinations or contrasting conditions may cause distractions. Color can affect moods and thus the mental well being of those who will inhabit this facility. Material and color selections conscious of this phenomena will be selected as a natural course of design.

The primary goal of this multi-building facility is to support the worship services of all distinctive faith groups. Additional goals for the facility include other services such as weddings, funerals, dedications and sacramental services. The multi-use nature of the facility also lends itself for the study of theological understandings, and general purpose gatherings. Operating staff is anticipated to be low; accommodating approximately 5 - 6 full time staff.

Material aesthetics including color and texture have been considered for the multi-use nature of the facility and have been provided for review by prospective users. We anticipate and propose a collaborative design process with various stakeholders of this facility to refine these selections and to ultimately arrive at a level of finish that all parties involved will enjoy and be proud of.

It is anticipated that the population or users will arrive with an expectation of reverence and worship due to the nature of the facility's purpose. As such, the preliminary selections made are intended to address these expectations and provide a similar level of reverence upon experiencing them. It is our intention to provide a level of finish that is not only acceptable, but that will exceed expectations. We intend to achieve this for through careful selection of the highest quality materials the budget will allow. In many cases, upgrades to finishes have already been proposed as part of our base contract as betterments to the Government.

Durability & Maintenance

Finishes have been selected to take advantage of maximum warranties and durability to stand up to repeated heavy usage. All architectural finishes will be a minimum of commercial grade quality and durability with industrial grade components utilized where appropriate, such as within utility areas. Wherever possible and applicable, factory finishes will be utilized to maximize durability and reduce the need for maintenance.



CHAPEL COMPLEX  
FORT HOOD, TX  
NE VIEW

Section:





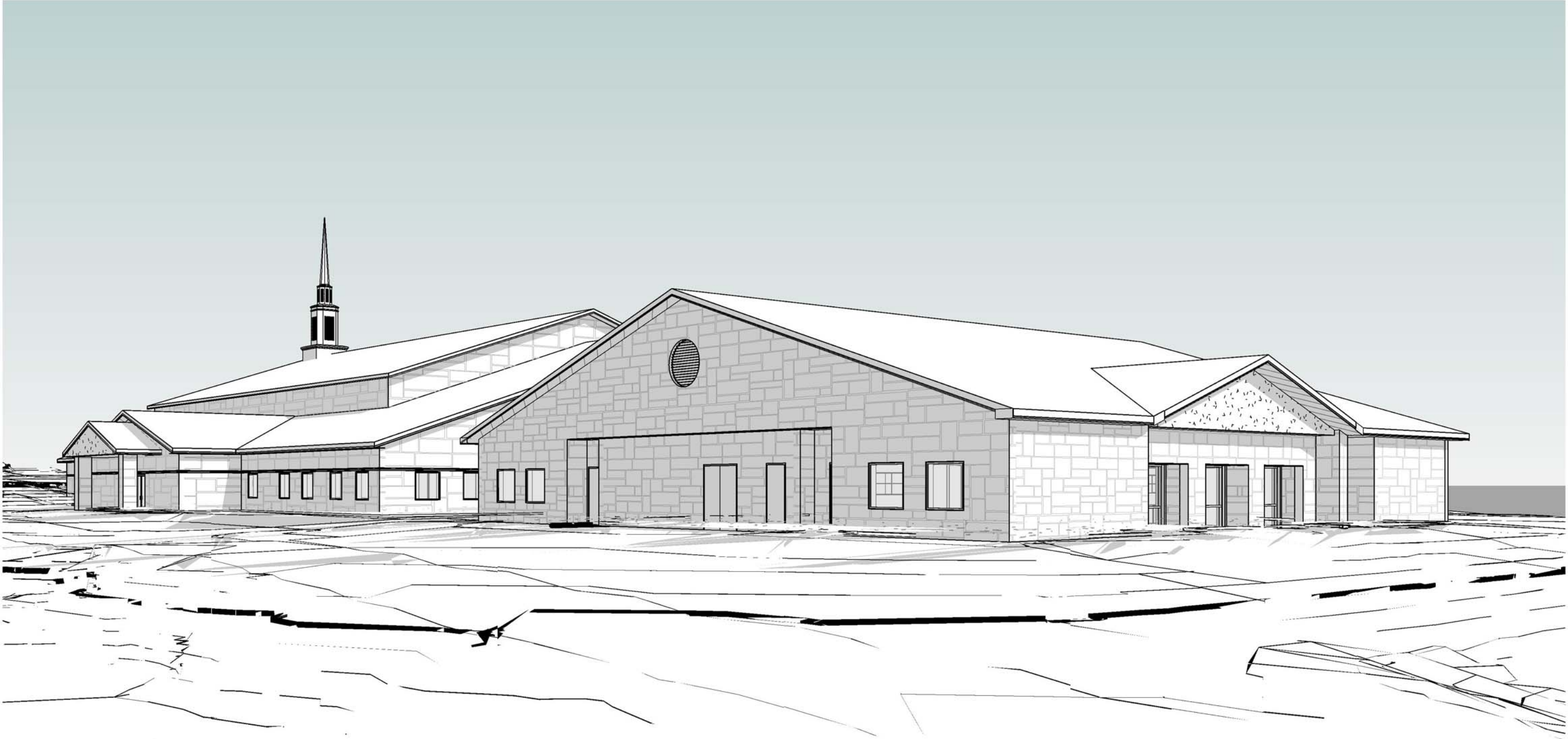


## CHAPEL COMPLEX & RELIGIOUS EDUCATION FACILITY FORT HOOD, TEXAS

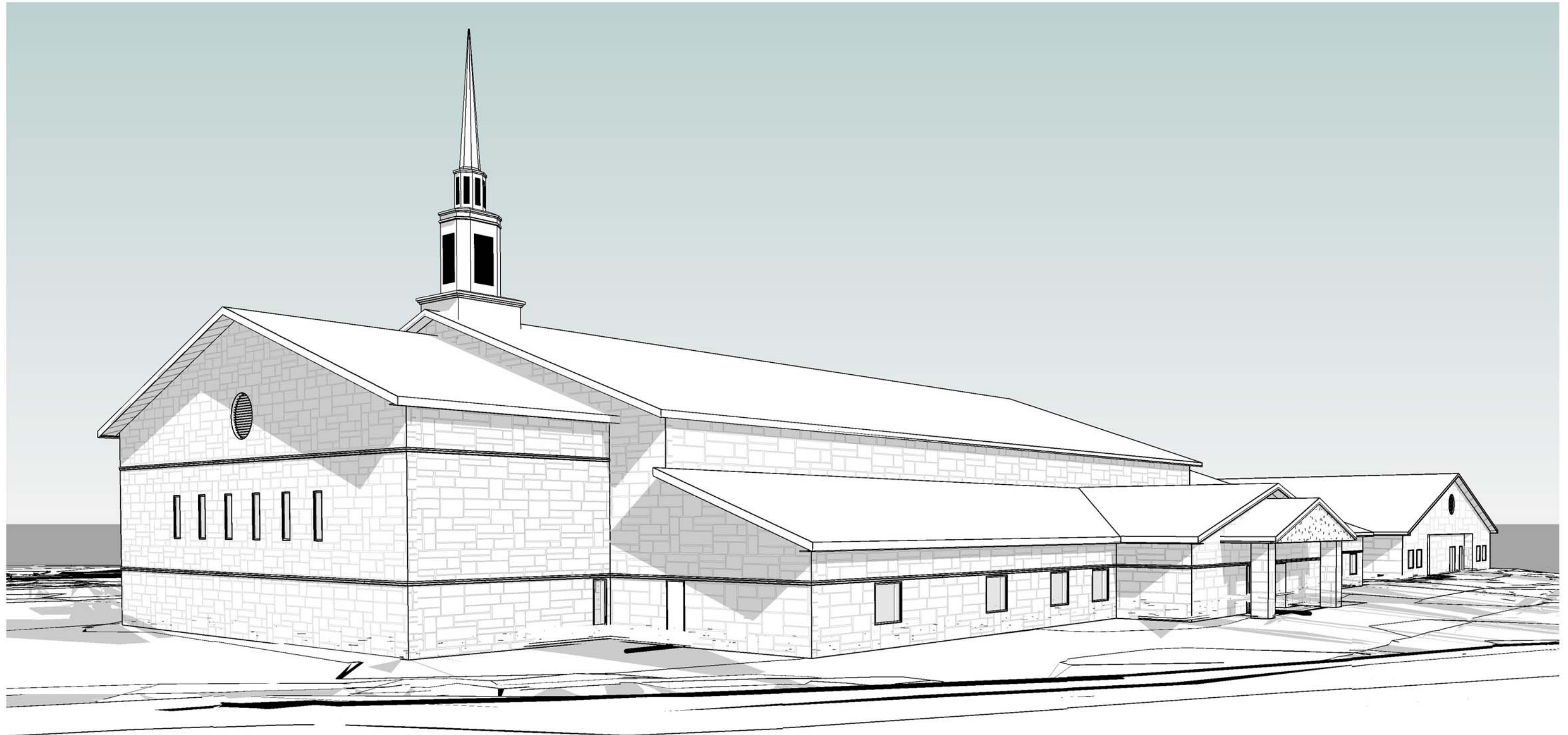


# CHAPEL COMPLEX & RELIGIOUS EDUCATION FACILITY FORT HOOD, TEXAS





**CHAPEL COMPLEX & RELIGIOUS EDUCATION FACILITY  
FORT HOOD, TEXAS**



# CHAPEL COMPLEX & RELIGIOUS EDUCATION FACILITY FORT HOOD, TEXAS

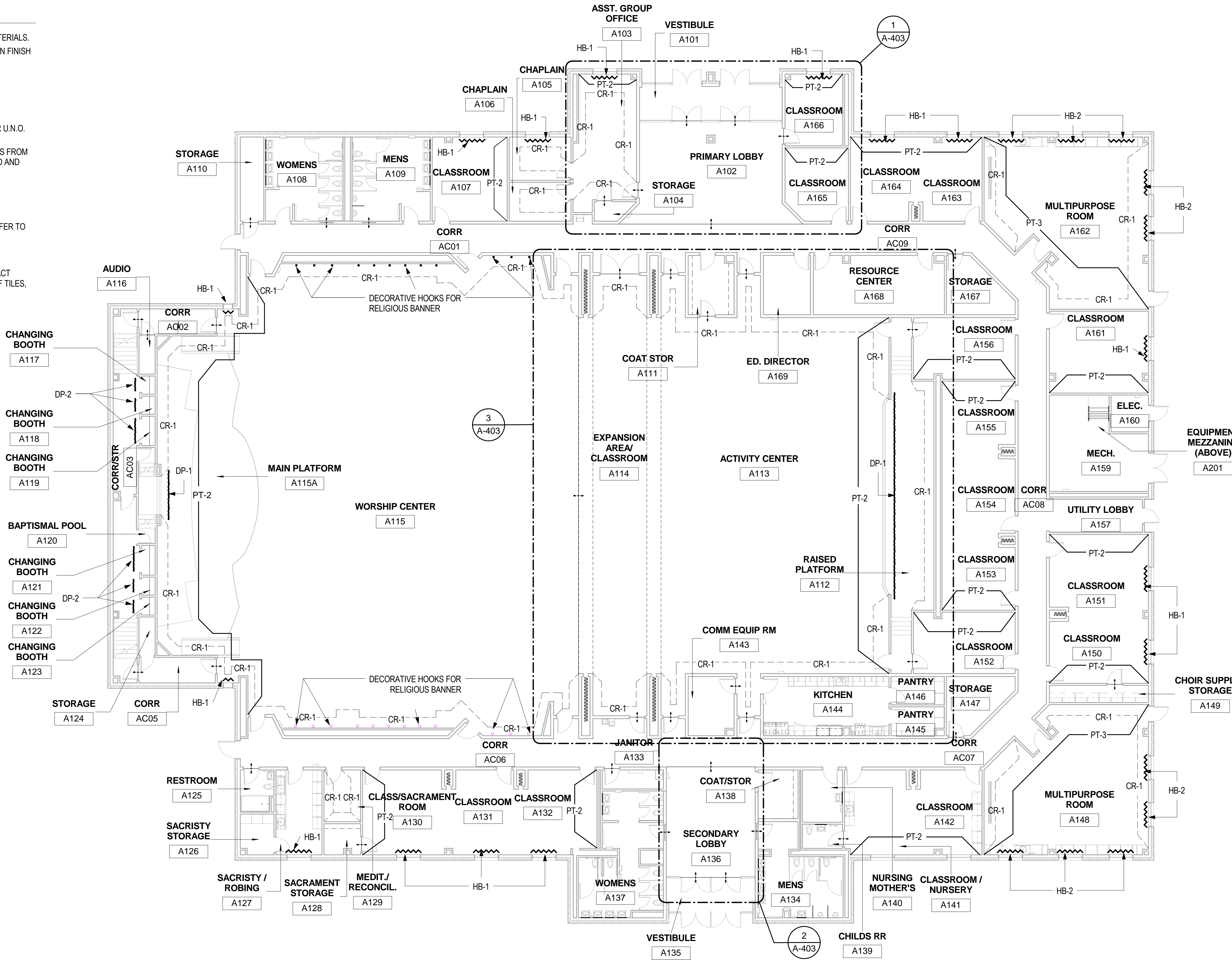


FINISH PLAN NOTES

1. REFER TO SPECIFICATIONS AND LIST OF FINISHES FOR ALL FINISH MATERIALS.
2. REFER TO ELEVATIONS FOR ADDITIONAL FINISHES NOT CALLED OUT ON FINISH PLANS/SCHEDULE.
3. ALL WALLS TO RECEIVE FRESH COAT OF PAINT, U.N.O.
4. ALL GYP. BD. CEILINGS SHALL BE PT-6 IN EGGSHELL FINISH, U.N.O.
5. ALL BASE IS RB-1 U.N.O.
6. ALL CARPET IS CPT-1 U.N.O.
7. NEW FLOORING TRANSITIONS SHALL OCCUR AT CENTERLINE OF DOOR U.N.O. REFER TO SHEET A-503 FOR ALL FLOORING TRANSITION DETAILS.
8. PROVIDE HARD RUBBER TRANSITION STRIPS AT ANY NEW TRANSITIONS FROM VCT TO CARPET. SUBMIT SAMPLE FROM MANUFACTURER'S STANDARD AND CUSTOM COLORS FOR ARCHITECT'S APPROVAL.
9. PROVIDE COVE BASE AT ALL FLOORING U.N.O.
10. PREPARE SLAB AS REQUIRED PER FLOOR FINISH MANUFACTURER.
11. REFER TO DOOR AND FRAME SCHEDULE FOR FINISHES.
12. PROVIDE WINDOW COVERINGS AT ALL EXTERIOR WINDOWS, U.N.O. REFER TO LIST OF FINISHES.
13. PROTECT WOOD FINISHES TO REMAIN DURING CONSTRUCTION AND DEMOLITION, IF APPLICABLE.
14. VINYL COMPOSITION TILE AND CARPET TILE GRIDS ARE BASED ON EXACT FINISH MATERIAL DIMENSIONS. FINISH PATTERNS UTILIZE FULL SIZE OF TILES, U.N.O. BEGIN PATTERN AS INDICATED.
15. EXPOSED METAL/ STRUCTURE TO BE PAINTED PT-8 U.N.O.

FINISH PLAN LEGEND

- FLOORING TRANSITION REFERENCE
- BLINDS AS SPECIFIED
- DRAPERY AS SPECIFIED
- PT- PAINT EXTENTS FOR ACCENT WALLS
- CR-1 CHAIR RAIL EXTENTS
- HB-1 HORIZONTAL MINI BLINDS
- HB-2 ROOM DARKENING HORIZONTAL MINI BLINDS
- DP-1 STAGE CURTAINS
- DP-2 DRAPERY PANELS



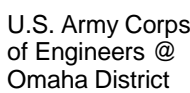


## ARCH / LANDSCAPE PACKAGE - INTERIM DESIGN - NOT FOR CONSTRUCTION



CHAPEL COMPLEX & RELIGIOUS EDUCATION  
FACILITY  
Bldg 320 , Corner of Tank Destroyer and 31st Street  
Fort Hood, Texas 76544

1. ARCHITECTURAL FINISHED FLOOR ELEVATION OF 100'-0" IS EQUAL TO THE CIVIL FINISH FLOOR ELEVATION OF 894.50'. RE: CIVIL DRAWINGS
2. SIDEWALKS AT BUILDING AND STRUCTURES SHALL BE 14" MAX BELOW FINISH FLOOR AT DOORS AND SLOPE AWAY IN ACCORDANCE WITH ADA.
3. PAINT ALL EXPOSED METAL THAT IS NOT SPECIFIED OR INDICATED TO RECEIVE FACTORY FINISH.
4. SEE PLANS AND SCHEDULE FOR DOOR AND WINDOW TYPES AND SIZES.
5. ALL EXPOSED FLASHING SHALL BE FACTORY FINISHED BY MANUFACTURER/SUPPLIER
6. REFER TO PROJECT MANUAL FOR EXTERIOR FINISHES.

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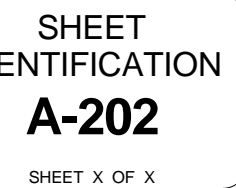
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Author	Checker	W9128F-09-R-0041
SUBMITTED BY:		CONTRACT NO.:
Approver		W9128F-09-C0021
PLOT SCALE:	PLOT DATE:	FILE NUMBER:
As indicated	11-09-09	A-201
SIZE:	FILE NAME:	
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**CHAPEL COMPLEX & RELIGIOUS EDUCATION  
FACILITY**  
Idg 320 , Corner of Tank Destroyer and 31st Street  
Fort Hood, Texas 76544

SHEET  
IDENTIFICATION  
**A-201**  
SHEET X OF X

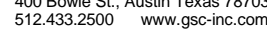
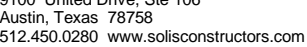
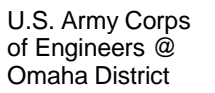
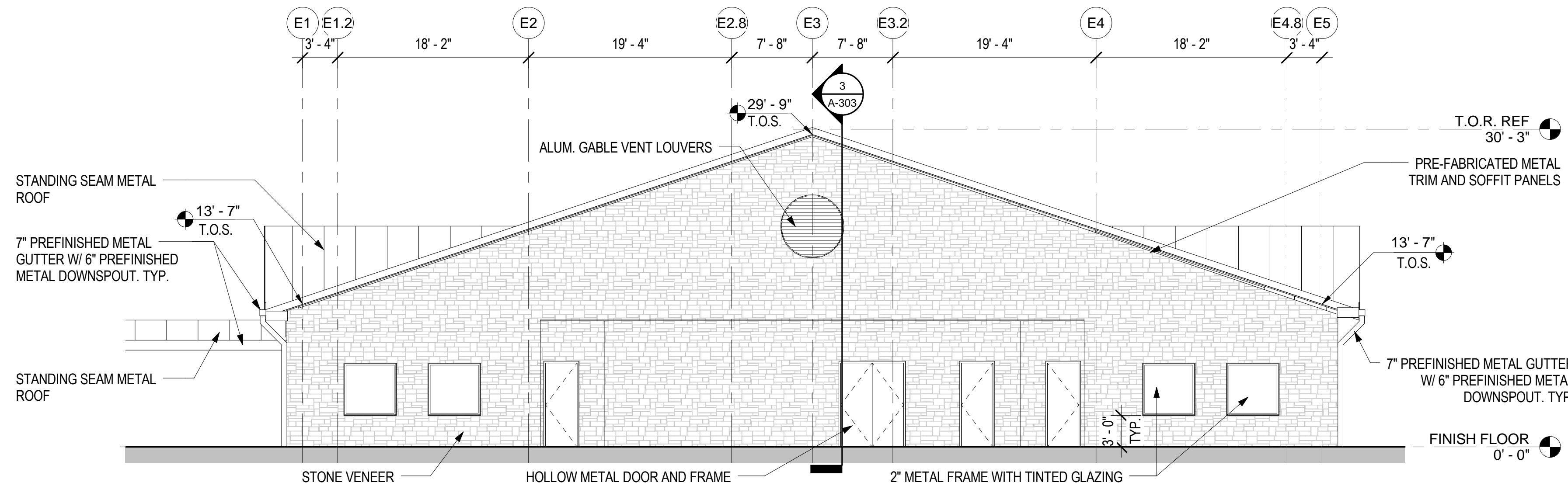


1. ARCHITECTURAL FINISHED FLOOR ELEVATION OF 100'-0" IS EQUAL TO THE CIVIL FINISH FLOOR ELEVATION OF 894.50'. RE: CIVIL DRAWINGS
2. SIDEWALKS AT BUILDING AND STRUCTURES SHALL BE 1/4" MAX BELOW FINISH FLOOR AT DOORS AND SLOPE AWAY IN ACCORDANCE WITH ADA.
3. PAINT ALL EXPOSED METAL THAT IS NOT SPECIFIED OR INDICATED TO RECEIVE FACTORY FINISH.
4. SEE PLANS AND SCHEDULE FOR DOOR AND WINDOW TYPES AND SIZES.
5. ALL EXPOSED FLASHING SHALL BE FACTORY FINISHED BY MANUFACTURER/SUPPLIER
6. REFER TO PROJECT MANUAL FOR EXTERIOR FINISHES.





1. ARCHITECTURAL FINISHED FLOOR ELEVATION OF 100'-0" IS EQUAL TO THE CIVIL FINISH FLOOR ELEVATION OF 894.50'. RE: CIVIL DRAWINGS
2. SIDEWALKS AT BUILDING AND STRUCTURES SHALL BE 1/4" MAX BELOW FINISH FLOOR AT DOORS AND SLOPE AWAY IN ACCORDANCE WITH ADA.
3. PAINT ALL EXPOSED METAL THAT IS NOT SPECIFIED OR INDICATED TO RECEIVE FACTORY FINISH.
4. SEE PLANS AND SCHEDULE FOR DOOR AND WINDOW TYPES AND SIZES.
5. ALL EXPOSED FLASHING SHALL BE FACTORY FINISHED BY MANUFACTURER/SUPPLIER
6. REFER TO PROJECT MANUAL FOR EXTERIOR FINISHES.

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**Designer:** Omaha District, Omaha Nebraska  
**DATE:** 7/6/2009 5:58:13 PM  
**BY:** CKD BY: W9128F-09-R-0041  
**Author:** Checker  
**DATE:** 7/6/2009 5:58:13 PM  
**CONTRACT NO.:** W9128F-09-R-0041  
**APPROVED BY:** APPROVER: W9128F-09-R-0021  
**APPROVER:** APPROVER: W9128F-09-R-0021  
**LOT SCALE:** 1"=40'-0" 1"=40'-0"  
**FILE NUMBER:** 7-53  
**FILE NAME:** 22"x34"

**CHAPEL COMPLEX & RELIGIOUS EDUCATION  
FACILITY**  
Bldg 320 , Corner of Tank Destroyer and 31st Street  
Fort Hood, Texas 76544

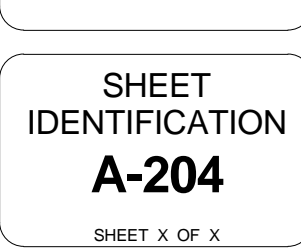
## EXTERIOR ELEVATIONS

SHEET  
IDENTIFICATION  
**A-203**

SHEET X OF X

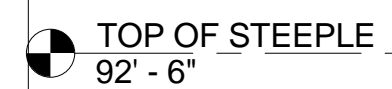


1. ARCHITECTURAL FINISHED FLOOR ELEVATION OF 100'-0" IS EQUAL TO THE CIVIL FINISH FLOOR ELEVATION OF 894.50'. RE: CIVIL DRAWINGS
2. SIDEWALKS AT BUILDING AND STRUCTURES SHALL BE 1/4" MAX BELOW FINISH FLOOR AT DOORS AND SLOPE AWAY IN ACCORDANCE WITH ADA.
3. PAINT ALL EXPOSED METAL THAT IS NOT SPECIFIED OR INDICATED TO RECEIVE FACTORY FINISH.
4. SEE PLANS AND SCHEDULE FOR DOOR AND WINDOW TYPES AND SIZES.
5. ALL EXPOSED FLASHING SHALL BE FACTORY FINISHED BY MANUFACTURER/SUPPLIER
6. REFER TO PROJECT MANUAL FOR EXTERIOR FINISHES.





1. ARCHITECTURAL FINISHED FLOOR ELEVATION OF 100'-0" IS EQUAL TO THE CIVIL FINISH FLOOR ELEVATION OF 894.50'. RE: CIVIL DRAWINGS
2. RE: STRUCTURAL FOR ALL FINAL TOP OF STEEL ELEVATIONS, ARCHITECTURAL STEEL ELEVATIONS SHOWN FOR REFERENCE ONLY.
3. ALL EXTERIOR METAL "STRUCTURAL COLUMNS, RAILS & EXPOSED ROOF DECK" TO BE GALVANIZED AND PAINTED AS NOTED.



This architectural section drawing illustrates the interior of a church building, showing a cross-section from the main floor to the roof. The drawing includes various rooms and structural elements, with labels and callouts providing detailed information.

**Rooms and Spaces:**

- MAIN PLATFORM:** Labeled A115A, located on the left side of the main floor.
- WORSHIP CENTER:** Labeled A115, located in the center of the main floor.
- EXPANSION AREA/ CLASSROOM:** Labeled A114, located in the center of the main floor, adjacent to the Worship Center.
- ACTIVITY CENTER:** Labeled A113, located on the right side of the main floor.
- MEZZ.:** Labeled A115D, located on the upper level.
- CLASSROOM:** Labeled A154, located on the right side of the upper level.
- CORR:** Labeled AC08, located on the right side of the upper level.
- UTILITY LOBBY:** Labeled A157, located on the right side of the upper level.

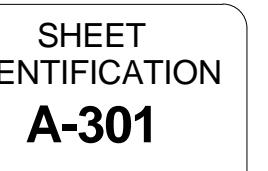
**Structural and Material Callouts:**

- METAL SOFFIT:** Indicated on the left side of the roof.
- STANDING SEAM METAL ROOF:** Indicated on the left side of the roof.
- PRE-MANUFACTURED STEEPLE; REFER TO SPEC'S:** Located at the top left of the building.
- LAY-IN ACOUSTICAL CEILING; GRID TO MATCH ROOF SLOPE:** Indicated in the upper right section.
- SSMR:** Structural Steel Moment Resisting, indicated in the upper right section.
- PRE-MANUFACTURED METAL SOFFIT PANELS:** Indicated on the right side of the roof.
- STRUCTURE; REFER TO STRUCTURAL DRAWINGS FOR ADDITIONAL INFORMATION:** Indicated on the right side of the roof.

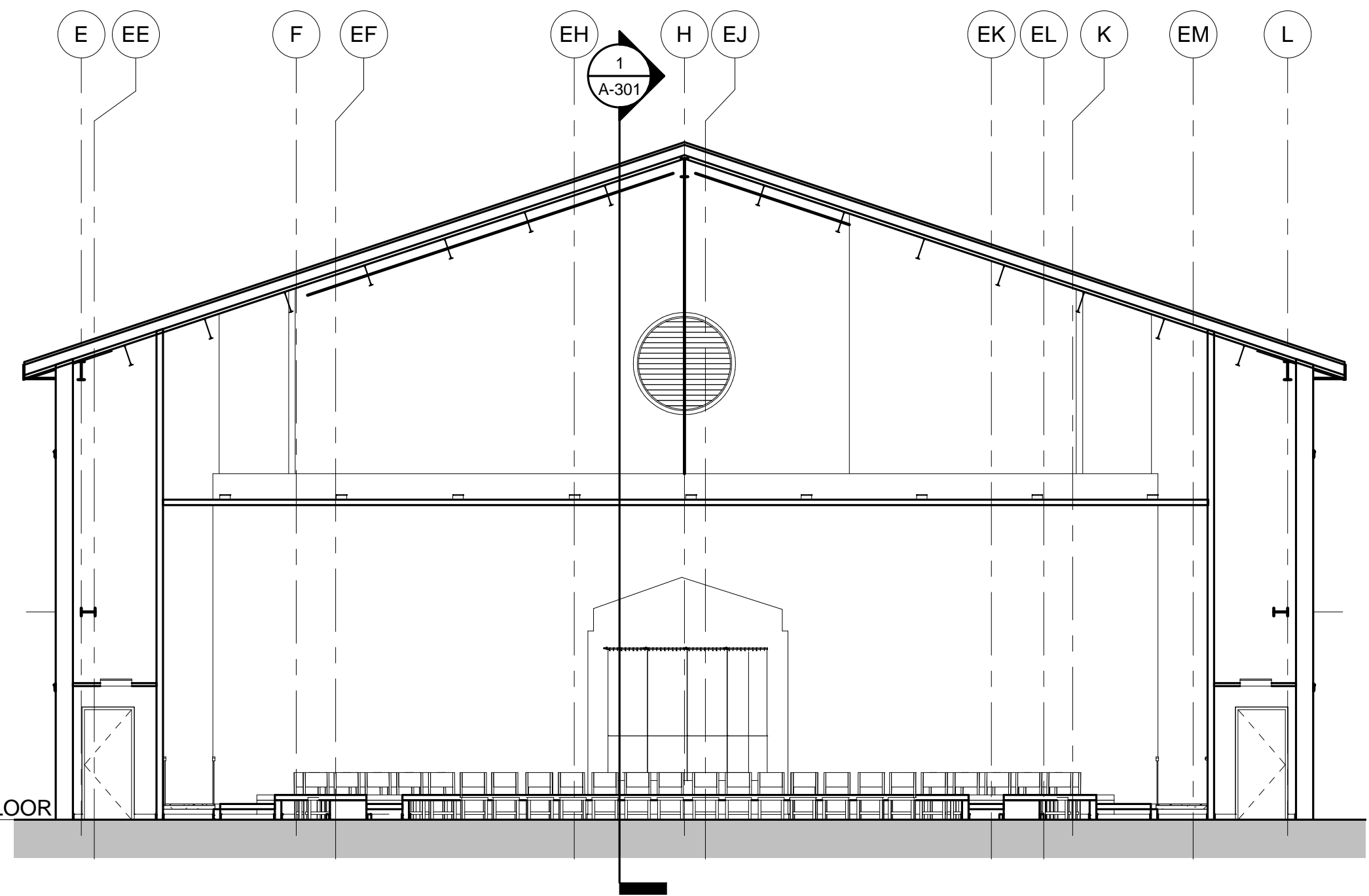
**Other Labels and Callouts:**

- FIRE EXTINGUISHER CABINET: REFER TO A-004:** Indicated at the bottom left and bottom right of the main floor.
- FOLDING PARTITIONS:** Indicated in the center of the main floor.
- Callouts:** Various circular callouts with numbers (1, 2, 3, 4, 5, 5.3, 6, 6.3, 7, 7.3, 7.7, 8, 8.7, 9, 9.5, 10, 11, 12) and alphanumeric codes (A-302, A-501, A-502, A-115A, A-115, A-114, A-113, A-115D, A-154, AC08, A-157) are distributed throughout the drawing, pointing to specific structural and material details.

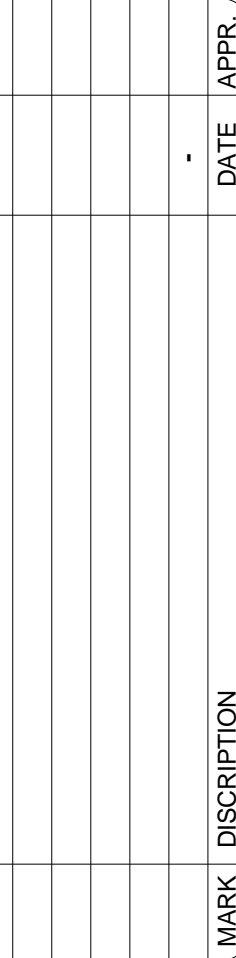
1 BLDG SECTION - CHAPEL COMPLEX (EAST TO WEST)  
1/8" = 1'-0"



1. ARCHITECTURAL FINISHED FLOOR ELEVATION OF 100'-0" IS EQUAL TO THE CIVIL FINISH FLOOR ELEVATION OF 894.50'. RE: CIVIL DRAWINGS
2. RE: STRUCTURAL FOR ALL FINAL TOP OF STEEL ELEVATIONS. ARCHITECTURAL STEEL ELEVATIONS SHOWN FOR REFERENCE ONLY.
3. ALL EXTERIOR METAL "STRUCTURAL COLUMNS, RAILS & EXPOSED ROOF DECK" TO BE GALVANIZED AND PAINTED AS NOTED.



2 BLDG SECTION - CHAPEL STAGE  
1/8" = 1'-0"



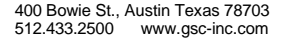
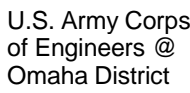
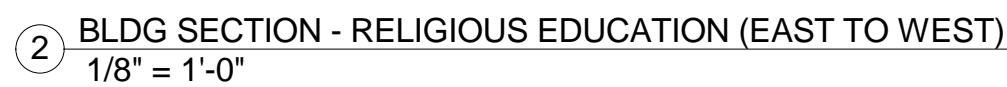
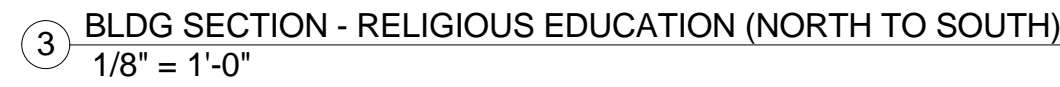
Omaha District, Omaha Nebraska	DWYB BY:	CKD BY:	SOLICITATION NO.:
	Author	Checker	W912BF-09-R-0041
	SUBMITTED BY:	CONTRACT NO.:	
	Approver	W912BF-09-C00021	
SOLIS CONSTRUCTORS, INC. 9100 UNITED DRIVE, SUITE 106 AUSTIN, TX 78758	PLOT SCALE:	PLOT DATE:	FILE NUMBER:
	As indicated	11-09-09	A-302
	SIZE:	FILE NAME:	
	22"x34"		

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SHEET  
IDENTIFICATION  
**A-302**  
SHEET X OF X



- BUILDING SECTION GENERAL NOTES  
12" = 1'-0"

[illegible]

U.S. Army Corps of Engineers Omaha District, Omaha Nebraska	DESIGNED BY:	1/16/2009 5:58:55 PM
	DRAWN BY:	CKD BY:
	Author	Checker
	SOLICITATION NO.: W9128F-09-R-0041	
SOLIS CONSTRUCTORS, INC. 9100 UNDER DRIVE, SUITE 106 AUSTIN, TX 78758	SUBMITTED BY:	CONTRACT NO.: W9128F-09-C0021
	Approver	
	PLOT SCALE: As indicated	PLOT DATE: 11-09-09
	27'x34'	FILE NUMBER: A-303

**CHAPEL COMPLEX & RELIGIOUS EDUCATION  
FACILITY**  
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Fort Hood, Texas 76544

SHEET  
IDENTIFICATION  
**A-303**  
SHEET X OF X

## **APPENDIX G**

### **GIS Data**

No additional items of GIS Data information or requirements are being provided beyond those in other parts of the contract documents.

## APPENDIX H

### Exterior Signage

**Project:** Recommendation for sign placement at the Family Life Center site, PN71515 FY10. Per Fort Hood Installation Design Guide, March 2007, chapter 11 and III CORPS & FH REG 420-5, 19 October 2007, appendix C the following recommendations apply for the placement of a temporary construction sign.

#### *Site Sign*

Erection and placement of temporary sign shall comply with the following requirements. Must coordinate placement with USACE CTAO, Fort Hood DPW Master Planning, and Contractor. Please see site map below.

#### *Location*

- On large construction site, place sign strategically near a high visibility site.
- Place sign in area free of visual clutter, landscape materials, and away from other temporary signs.
- Place sign in location that allow enough time for the user to read and react to the message.
- Sign should not be placed to block roadway sight lines.
- Place sign approximately 1.2 meters (4 feet) above ground level to be within 10 degrees of the driver's line of vision.
- Provide proper placement to avoid a hazard to children or other pedestrians.



**APPENDIX I**

**Acceptable Plant List**

Coordinate with the Installation at the time of Contract Award. No Plant List requirements are being provided in this section.



## **APPENDIX J**

### **Drawings**

Drawings under separate cover.

## APPENDIX K

## Utility Cost Information

The following utility rates for this installation are provided for design:

**Electrical:**

Demand Charge - \$0.11 per kilowatt – (Use Energy Charge, Blended Rate)

Energy Charge - \$0.07530 per kilowatt-hour (blended annual energy and demand cost)

**Natural Gas:**

Commodity Charge Rate - \$8.11 per thousand cubic feet

**Water:**

Commodity Charge Rate - \$0.86150 per KGAL

**Sewer:**

Commodity Charge Rate - \$1.33710 per KGAL

**Purchased/Central Steam:**

Commodity Charge Rate - \$x.xx per [unit of measure] - Not Used

**Purchased High Temperature Water:**

Commodity Charge Rate - \$x.xx per [unit of measure] – Not Used

**Purchased Chilled Water:**

Commodity Charge Rate - \$x.xx per [unit of measure] – Not Used

**NOTE:** All above cost are based on an annual average.

**LEED Project Credit Guidance (OCT 09)**

This spreadsheet indicates Army required credits, Army preferred credits, project-specific ranking of individual point preferences, assumptions guidance for individual credits, and references to related language in the RFP for individual credits.

	LEED Credit Paragraph		Army Guidance: Required - Preferred - Avoid	Project Preference Ranking: (1=most preferred, blank=no preference, X=preference not applicable to this credit, Rqd=required)	
		LEED Project Credit Guidance			
PAR		FEATURE			REMARKS
<b><u>SUSTAINABLE SITES</u></b>					
SSPR1		Construction Activity Pollution Prevention (PREREQUISITE)	Rqd	Rqd	All LEED prerequisites are required to be met.
SS1		Site Selection		X	See paragraph LEED CREDITS COORDINATION.
SS2		Development Density & Community Connectivity - OPTION 1 DENSITY		X	See paragraph LEED CREDITS COORDINATION.

	Development Density & Community Connectivity - OPTION 2 CONNECTIVITY		X	See paragraph LEED CREDITS COORDINATION.
SS3	Brownfield Redevelopment		X	See paragraph LEED CREDITS COORDINATION.
SS4.1	Alternative Transportation: Public Transportation Access		X	See paragraph LEED CREDITS COORDINATION.
SS4.2	Alternative Transportation: Bicycle Storage & Changing Rooms	Pref		Assume that non-transient building occupants are NOT housed on Post unless indicated otherwise.
SS4.3	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - OPTION 1			Requires provision of vehicles, which cannot be purchased with construction funds. Assume Government will not provide vehicles unless indicated otherwise. Assume that 50% of GOV fleet is NOT alternative fuel vehicles unless indicated otherwise.
SS4.3	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - OPTION 2	Pref		
SS4.3	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - OPTION 3			Requires provision of vehicle refueling stations. Installation must support type of fuel and commit to maintaining/supporting refueling stations.
SS4.4	Alternative Transportation: Parking Capacity	Pref		
SS5.1	Site Development: Protect or Restore Habitat			

SS5.2	Site Development: Maximize Open Space	Pref		Assume AGMBC option for aggregated open space at another location on the installation is not available to the project unless indicated otherwise.
SS6.1	Stormwater Design: Quantity Control	Pref		See paragraph STORMWATER MANAGEMENT.
SS6.2	Stormwater Design: Quality Control	Pref		See paragraph STORMWATER MANAGEMENT.
SS7.1	Heat Island Effect: Non-Roof			
SS7.2	Heat Island Effect: Roof	Pref		Coordinate with nearby airfield requirements, which may preclude this credit.
SS8	Light Pollution Reduction	Pref		
<b>WATER EFFICIENCY</b>				
WEPR1	Water Use Reduction (Version 3 only)	Rqd	Rqd	All LEED prerequisites are required to be met.
WE1.1	Water Efficient Landscaping: Reduce by 50%	Pref		See paragraph IRRIGATION. Project must include landscaping to be eligible for this credit.
WE1.2	Water Efficient Landscaping: No Potable Water Use or No Irrigation	Pref		Project must include landscaping to be eligible for this credit.
WE2	Innovative Wastewater Technologies - OPTION 1			
WE2	Innovative Wastewater Technologies - OPTION 2			
WE3	Water Use Reduction	Pref		See paragraph BUILDING WATER USE REDUCTION.
<b>ENERGY AND ATMOSPHERE</b>				

EAPR1	Fundamental Commissioning of the Building Energy Systems (PREREQUISITE)	Rqd	Rqd	All LEED prerequisites are required to be met.
EAPR2	Minimum Energy Performance (PREREQUISITE)	Rqd	Rqd	All LEED prerequisites are required to be met.
EAPR3	Fundamental Refrigerant Management (PREREQUISITE)	Rqd	Rqd	All LEED prerequisites are required to be met.
EA1	Optimize Energy Performance	Rqd	1	Earning of LEED EA1 points as indicated in paragraph <b>ENERGY CONSERVATION</b> , as a minimum, is required.
EA2.1	On-Site Renewable Energy	Pref		See paragraph <b>ENERGY CONSERVATION</b> .
EA3	Enhanced Commissioning			The Commissioning Authority may be provided through the Design-Build Contractor only if in accordance with USGBC Credit Interpretation Ruling (CIR) dated 9/15/06. Commissioning Authority activities begin during design phase and continue well beyond beneficial occupancy. Assume Government will not provide CxA post-occupancy activities unless indicated otherwise.
EA4	Enhanced Refrigerant Management			
EA5	Measurement & Verification			Assume Government will not provide post-occupancy activities unless indicated otherwise.
EA6	Green Power		X	See paragraph <b>LEED CREDITS COORDINATION</b> .
<b>MATERIALS AND RESOURCES</b>				
MRPR1	Storage & Collection of Recyclables (PREREQUISITE)	Rqd	Rqd	All LEED prerequisites are required to be met. Coordinate with

				Installation during design development on collection service and receptacles.
MR1	Building Reuse			
MR2.1	Construction Waste Management: Divert 50% From Disposal	Pref		See paragraph CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT.
MR2.2	Construction Waste Management: Divert 75% From Disposal	Pref		
MR3	Materials Reuse			
MR4.1	Recycled Content: 10% (post-consumer + 1/2 pre-consumer)	Pref		See paragraph RECYCLED CONTENT.
MR4.2	Recycled Content: 20% (post-consumer + 1/2 pre-consumer)	Pref		
MR5.1	Regional Materials:10% Extracted, Processed & Manufactured Regionally			
MR5.2	Regional Materials:20% Extracted, Processed & Manufactured Regionally			
MR6	Rapidly Renewable Materials	Pref		See paragraph BIOBASED AND ENVIRONMENTALLY PREFERABLE MATERIALS and paragraph FEDERAL BIOBASED PRODUCTS PREFERRED

				PROCUREMENT PROGRAM.
MR7	Certified Wood	Pref		See paragraph BIOBASED AND ENVIRONMENTALLY PREFERABLE MATERIALS.
<b><u>INDOOR ENVIRONMENTAL QUALITY</u></b>				
EQPR1	Minimum IAQ Performance (PREREQUISITE)	Rqd	Rqd	All LEED prerequisites are required to be met.
EQPR2	Environmental Tobacco Smoke (ETS) Control (PREREQUISITE)	Rqd	Rqd	All LEED prerequisites are required to be met. Assume all buildings are smoke free unless indicated otherwise (family housing, barracks and other lodging are facility types where smoking may be permitted in some cases).
EQ1	Outdoor Air Delivery Monitoring			
EQ2	Increased Ventilation			
EQ3.1	Construction IAQ Management Plan: During Construction	Pref		See paragraph CONSTRUCTION IAQ MANAGEMENT.
EQ3.2	Construction IAQ Management Plan: Before Occupancy	Pref		See paragraph CONSTRUCTION IAQ MANAGEMENT.
EQ4.1	Low Emitting Materials: Adhesives & Sealants	Pref		See paragraph LOW-EMITTING MATERIALS.
EQ4.2	Low Emitting Materials: Paints & Coatings	Pref		See paragraph LOW-EMITTING MATERIALS.
EQ4.3	Low Emitting Materials: Carpet/Flooring Systems	Pref		See paragraph LOW-EMITTING MATERIALS.
EQ4.4	Low Emitting Materials: Composite Wood & Agrifiber Products	Pref		See paragraph LOW-EMITTING MATERIALS.
EQ5	Indoor Chemical & Pollutant Source Control	Pref		System requiring weekly cleaning to earn this credit is not a permitted option unless indicated



				otherwise.
EQ6.1	Controllability of Systems: Lighting			
EQ6.2	Controllability of Systems: Thermal Comfort			
EQ7.1	Thermal Comfort: Design	Pref		See paragraph APPLICABLE CRITERIA
EQ7.2	Thermal Comfort: Verification			Project must earn credit EQ7.1 to be eligible for this credit. Assume Government will not provide post-occupancy activities unless indicated otherwise.
EQ8.1	Daylight & Views: Daylight 75% of Spaces	Pref		See paragraph DAYLIGHTING.
EQ8.2	Daylight & Views: Views for 90% of Spaces	Pref		
<b>INNOVATION &amp; DESIGN PROCESS</b>				
IDc1.1	Innovation in Design			See paragraph INNOVATION AND DESIGN CREDITS. Assume Government will not provide any activities associated with ID credits.
IDc1.2	Innovation in Design			
IDc1.3	Innovation in Design			
IDc1.4	Innovation in Design			
IDc2	LEED Accredited Professional	Rqd	Rqd	LEED AP during design and construction is required.
<b>REGIONAL PRIORITY CREDITS (Version 3 only)</b>				See paragraph LEED CREDITS COORDINATION.

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# Owner's Project Requirements Document for LEED Fundamental Commissioning

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Project: Family Life Center (Chapel Family Life Center and Multi-Purpose Activity Center)

Approved:

\_\_\_\_\_  
Name

\_\_\_\_\_  
Owner's Representative

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name

\_\_\_\_\_  
Design Agent's Representative

\_\_\_\_\_  
Date

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## Overview and Instructions

The purpose of this document is to provide clear and concise documentation of the Owner's goals, expectations and requirements for commissioned systems, and shall be utilized throughout the project delivery and commissioning process to provide an informed baseline and focus for design development and for validating systems' energy and environmental performance.

The Owner's Project Requirements Document is a required document for LEED-NC EA Prerequisite Fundamental Commissioning of the Building Energy Systems. It shall be completed by the Corps District/Design Agent based on coordination with the Installation/User/Proponent and shall be approved by the Installation/User/Proponent representative.

The intent of the Owner's Project Requirements Document is to detail the functional requirements of a project and the expectations of the building's use and operation as it relates to commissioned systems. This template contains the basic recommended components indicated in the LEED Reference Guide. It should be adapted as needed to suit the project, remaining reflective of the LEED intent.

The Owner's Project Requirements Document should ideally be completed before the start of design and furnished to the design team. It must be completed prior to the approval of Contractor submittals of any commissioned equipment or systems to meet LEED requirements.

Updates to the Owner's Project Requirements Document throughout the course of project delivery shall be made by the Corps District/Design Agent based on decisions and agreements coordinated with and agreed to by the Installation/User/Proponent.

The Owner's Project Requirements Document shall be included in the project's LEED documentation file under EA PR1, Fundamental Commissioning of the Building Energy Systems.

## **Owner's Project Requirements Document for LEED Fundamental Commissioning**

### **Table of Contents**

1. Owner and User Requirements
  - Primary Purpose, Program and Use
  - Project History
  - Broad Goals
2. Environmental and Sustainability Goals
  - Energy Efficiency Goals
  - General
  - Siting
  - Building Façade
  - Building Fenestration
  - Building Envelope
  - Roof
  - Other
3. Indoor Environmental Quality Requirements
  - Intended Use
  - Occupancy Schedule
  - Accommodations for After-Hours Use
  - Lighting, Temperature, Humidity, Air Quality, Ventilation, Filtration
  - Acoustics
  - Occupant Ability to Adjust System Controls
  - Types of Lighting
4. Equipment and Systems Expectations
  - Space Heating
  - Ventilation
  - Air Conditioning
  - Refrigeration
  - HVAC Controls
  - Domestic Hot Water
  - Lighting Controls
  - Daylighting Controls
  - Emergency Power
  - Other
5. Building Occupant and O&M Personnel Requirements
  - Facility Operation
  - EMCS
  - Occupant Training and Orientation
  - O&M Staff Training and Orientation

TABLE 1

## **1. *Owner and User Requirements***

What is the primary purpose, program and use of this project? (example: office building with data center)

The Chapel Family Life Center includes a counseling suite and a multitude of gathering spaces for training, meetings, etc. The Multi-Purpose Activity Center includes some more specialized activity spaces, particularly focused on families with children.

Describe pertinent project history. (example: standard design development)

The Chapel Family Life Center was developed as an Army Standard design in 1990-95 for the purposes just described and the Multi-Purpose Activity Center is a mission unique facility type which may or may not become an Army Standard Design in the future.

### ***Broad Goals***

What are the broad goals relative to program needs?

Both facility types will support ongoing activities during the day and evenings to support soldiers and their family members in a variety of activities to strengthen their spiritual health and maintain the same.

What are the broad goals relative to future expansion?

No future expansion is envisioned at this site.

What are the broad goals relative to flexibility?

While the counseling suite is a relatively static group of spaces for a relatively uniform set of activities, almost all of the other spaces can support a wide range of activities with considerable potential for change over time.

What are the broad goals relative to quality of materials?

The facilities are intended to convey professionalism and very good quality, similar to private sector athletic, meeting and office facilities.

What are the broad goals relative to construction costs?

Meeting the Construction Cost Limitation.

What are the broad goals relative to operational costs?

Normal-to-economical cost levels.

Other broad goals: *(Insert as applicable)*

The spaces must be welcoming to a full spectrum of faith groups.

## **2. Environmental and Sustainability Goals**

What are the project goals relative to sustainability and environmental issues? (example: LEED Silver rating)

To acquire a LEED Silver Rating, or higher.

What are the project goals relative to energy efficiency? (example: Meet EPACT)

To Meet EPACT 05.

What are the project goals and requirements for building siting that will impact energy use?

Appropriate features for LEED Silver.

What are the project goals and requirements for building facade that will impact energy use?

Appropriate features for LEED Silver, but also appropriate to the aesthetic image being set by adjacent projects currently under construction.

What are the project goals and requirements for building fenestration that will impact energy use?

Appropriate features for LEED Silver, but also appropriate to the aesthetic image being set by adjacent projects currently under construction.

What are the project goals and requirements for building envelope that will impact energy use?

Appropriate features for LEED Silver, but also appropriate to the aesthetic image being set by adjacent projects currently under construction.

What are the project goals and requirements for building roof that will impact energy use?

Appropriate features for LEED Silver, but also appropriate to the aesthetic image being set by adjacent projects currently under construction.

Other: *(Insert as applicable)*

None.

### **3. Indoor Environmental Quality Requirements**

What is the intended use for all spaces? For all spaces that have an intended use that is not readily apparent from the space name, provide this information in Table 1.

Aside from obvious administrative and support spaces, the counseling suite supports this function and most other rooms support a wide variety of gatherings.

What is the anticipated occupancy schedule (numbers of occupants and time frames) for all occupied spaces? Indicate the default occupancy schedule below and for all spaces that have an occupancy schedule that differs from the default, provide this information in Table 1.

All spaces have the potential for use daily and during the evenings with a wide range of quantity levels and activity types; there will be almost no uniformity of pattern.

What accommodations for after-hours use are required? (example: access control, lighting controls, HVAC controls) Indicate general accommodations required below and for all spaces that have special requirements, provide this information in Table 1.

Only on rare occasions will these facilities be used after 11:00 PM or before 5:00 AM. They may support a Youth Group Lock-In/Sleep-Over from time to time.

What are the lighting, temperature, humidity, air quality, ventilation and filtration requirements for all spaces? Indicate the default requirements below and for all spaces that have a requirement that differs from the default, provide this information in Table 1.

Lighting: Normal lighting levels

Temperature: Normal temperature levels.

Humidity: Normal humidity levels.

Air Quality: Normal air quality levels

Ventilation: Normal ventilation levels.

Filtration: Normal filtration levels.

See Section 01 10 00, paragraph series 3 for acoustical requirements for all spaces.

Provide normal levels of occupant ability to adjust systems controls in all spaces, keeping in mind that most spaces have the potential for being in use when most other spaces are vacant

See Section 01 10 00, paragraph series 3 for types-of-lighting requirements for all spaces.

#### **4. Equipment and System Expectations**

*(Coordinate all of the following sections with the contract representative during the design phase of this project, after award. Complete for each category as applicable or indicate "none identified" or "N/A". Add desired features information for other anticipated commissioned systems as applicable)*

Indicate desired features for the following commissioned system: Space Heating

Desired Type: \_\_\_\_\_

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_

Indicate desired features for the following commissioned system: Ventilation

Desired Type: \_\_\_\_\_

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_

Indicate desired features for the following commissioned system: Air Conditioning

Desired Type: \_\_\_\_\_

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_

Indicate desired features for the following commissioned system: Refrigeration

Desired Type: \_\_\_\_\_

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_

Indicate desired features for the following commissioned system: HVAC Controls

Desired Type: \_\_\_\_\_

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_

Indicate desired features for the following commissioned system: Domestic Hot Water

Desired Type: \_\_\_\_\_

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_



Indicate desired features for the following commissioned system: Lighting Controls

Desired Type: \_\_\_\_\_

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_

Indicate desired features for the following commissioned system: Daylighting Controls

Desired Type: \_\_\_\_\_

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_

Indicate desired features for the following commissioned system: Emergency Power

Desired Type: \_\_\_\_\_

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_

Indicate desired features for the following commissioned system: Other - \_\_\_\_\_

Desired Type: \_\_\_\_\_

Quality: \_\_\_\_\_

Preferred Manufacturer: \_\_\_\_\_

Reliability: \_\_\_\_\_

Automation: \_\_\_\_\_

Flexibility: \_\_\_\_\_

Maintenance Requirements: \_\_\_\_\_

Efficiency Target: \_\_\_\_\_

Desired Technologies: \_\_\_\_\_

### **5. *Building Occupant and O&M Personnel Requirements***

How will the facility be operated? Who will operate the facility?

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Will the facility be connected to an EMCS? If so, what are the interface requirements? (example: monitoring points, control points, scheduling)

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What is the desired level of training and orientation for building occupants to understand and use the building systems?

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What is the desired level of training and orientation for O&M staff to understand and maintain the building systems?

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**Table 1**

Space	Use / Activity	Num of Occs	Special Occupancy Schedule	After Hours Use Reqmt.	Special Cooling Reqmt.	Special Heating Reqmt.	Special Humidity Reqmt.	Special Ventil./Filtration Reqmt.	Special Acoustic Reqmt.	Special Lighting Reqmt.	Special Occup Adjustability Reqmt.

## **APPENDIX N**

### **LEED Requirements for Multiple Contractor Combined Projects**

This circumstance does not apply to this project and no requirements are being provided.

## **APPENDIX O**

### **LEED Strategy Tables for Multiple Contractor Combined Projects**

This circumstance does not apply to this project and no requirements are being provided.

## APPENDIX P

### LEED Registration of Army Projects

15 April 2010

#### **Number of Registrations**

Each building must be registered separately, except multiple instances of a standard building on a shared site may be registered as a single project. If a single registration for multiple buildings is chosen, all buildings under the single registration must earn exactly the same points. Do not register buildings that are exempt from a specific LEED achievement requirement.

#### **Typical Registration Procedure**

1. Login, complete the online registration form (see guidance below) at the GBCI LEED Online website <http://www.gbci.org/DisplayPage.aspx?CMSPageID=174> and submit it online.
2. Pay the registration fee via credit card (USACE staff: credit card PR&C is funded by project design or S&A funds).
3. GBCI will follow up with a final invoice, the LEED-online passwords and template information.
4. The individual who registers the project online is, by default, the Project Administrator.

#### **Completing the Registration Form**

##### **BEFORE YOU BEGIN:**

**Create a personal account with USGBC if you do not have one.**

**You will need the following information:**

**Project name as it appears in P2 (obtain from USACE Project Manager)**

**Building number/physical address of project**

**Zip code for Installation/project location**

**Anticipated construction start and end dates**

**Total gross area all non-exempt buildings in registration**

**Total construction cost all non-exempt buildings only (see Project Details Section instructions below)**

##### **ACCOUNT/LOGIN INFORMATION**

1. The person registering the project **must have an account with USGBC** (login and password) to complete the form. Go to <http://www.gbci.org/>, click on "register a project" at the drop-down menu for project certification (at the top of the page) and select "register now for LEED 2009" to start the project registration process. If you have an account, login with your email address and password and select "register new project" to proceed. If you do not have an account, you may select "register a new account" and follow the instructions. It is recommended that you create an account separately on the USGBC website before you start the form. IMPORTANT: USACE team members are members of USGBC and are eligible for Member prices. USACE team members registering projects should be sure to include the USACE Corporate Access ID in their personal account profile (if you do not have it contact [richard.l.schneider@usace.army.mil](mailto:richard.l.schneider@usace.army.mil) or [judith.f.milton@usace.army.mil](mailto:judith.f.milton@usace.army.mil) for the number).
2. The Account/Login Information section is filled out by the person registering the project. It may be a Contractor or a USACE staff member.

##### **ELIGIBILITY SECTION**

Follow directions (accepting the terms and conditions)

Review your profile information and make corrections if needed

##### **RATING SYSTEM SELECTION SECTION**

Select single project registration and I know which rating system.

Select the rating system - currently only LEED-NC and LEED for Homes are approved for Army use without special approval.

LEED Minimum Program Requirements: select YES

**RATING SYSTEM RESULTS SECTION**

Confirm selected rating system.

**PROJECT INFORMATION SECTION**

**Project Title:** Begin the project title with a one-word identifier for the Installation. Do not include the word "Fort". After this match the project name used in P2 (contact the USACE Project Manager for this information) and identify the building being registered. Example: "Stewart 4<sup>th</sup> IBC - DFAC".

**Project Address 1 and 2:** This is the physical location of the project. Provide building number, street address, block number or whatever is known to best describe the location of the project on the Installation.

**Project City:** Installation Name

**State, Country, Zip Code:** Self-explanatory

**Anticipated Construction Start and End Dates:** Self-explanatory – give your best guess if unknown. Note that required data entry format is: 1 or 2 digit month/1 or 2 digit date/4 digit year (example 3/23/2010)

**Gross Square Footage:** Provide total area all buildings in LEED project. Exclude the area of any buildings that are exempt from the LEED achievement requirement (for example, exclude an unconditioned storage shed to be constructed with a barracks complex).

**Is Project Confidential:** Indicate NO except, if project has security sensitivity (elements that are FOUO or higher security), indicate YES.

**Notification of Local Chapter:** Indicate NO unless Government/USACE Project Manager requests you to indicate YES.

**Anticipated Project Type:** Select the most appropriate option from the drop-down menu.

**Anticipated Certification Level:** Select the applicable option from the drop-down menu (Silver is the usual level).

**PROJECT OWNER INFORMATION SECTION**

**Project Owner First Name, Last Name, email, phone, address:** The Project Owner is the USACE Project Manager. Obtain this info from the USACE Project Manager.

**Organization:** U.S. Army Corps of Engineers. This field MUST be completed this way because it will be used as a search field by higher HQ to find all USACE registered projects. You may supplement it with district name at the end but DO NOT revise or use an acronym.

**May we publish Owner information:** Indicate NO

**Owner Type:** Pick Federal Government from drop-down menu.

**Project Owner Assertion:** Check the box

**PAYMENT INFORMATION**

Self-explanatory

**APPENDIX Q**  
**REV 1.1 – 31 MAY 2009**  
**AREA COMPUTATIONS**

**Computation of Areas:** Compute the "gross area" and "net area" of facilities (excluding family housing) in accordance with the following subparagraphs:

**(1) Enclosed Spaces:** The "gross area" is the sum of all floor spaces with an average clear height  $\geq 6'-11"$  (as measured to the underside of the structural system) and having perimeter walls which are  $\geq 4'-11"$ . The area is calculated by measuring to the exterior dimensions of surfaces and walls.

**(2) Half-Scope Spaces:** Areas of the following spaces shall count as one-half scope when calculating "gross area":

- Balconies
- Porches
- Covered exterior loading platforms or facilities
- Covered but not enclosed passageways and walks
- Open stairways (both covered and uncovered)
- Covered ramps
- Interior corridors (Unaccompanied Enlisted Personnel Housing Only)

**(3) Excluded Spaces:** The following spaces shall be excluded from the "gross area" calculation:

- Crawl spaces
- Uncovered exterior loading platforms or facilities
- Exterior insulation applied to existing buildings
- Open courtyards
- Open paved terraces
- Uncovered ramps
- Uncovered stoops
- Utility tunnels and raceways
- Roof overhangs and soffits measuring less than 3'-0" from the exterior face of the building to the fascia

**(4) Net Floor Area:** Where required, "net area" is calculated by measuring the inside clear dimensions from the finish surfaces of walls. If required, overall "assignable net area" is determined by subtracting the following spaces from the "gross area":

- Basements not suited as office, special mechanical, or storage space
- Elevator shafts and machinery space
- Exterior walls
- Interior partitions
- Mechanical equipment and water supply equipment space
- Permanent corridors and hallways
- Stairs and stair towers
- Janitor closets
- Electrical equipment space
- Electronic/communications equipment space



RMS SUBMITTAL REGISTER INPUT FORM			CONTRACT NUMBER		DELIVERY ORDER																				
TITLE AND LOCATION																									
Button	<-----Right click for Instructions		TYPE OF SUBMITTAL								CLASSIFICATION				REVIEWING OFFICE										
SECTION	PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	01 - PRECON SUBMITTALS	02 - SHOP DRAWINGS	03 - PRODUCT DATA	04 - SAMPLES	05 - DESIGN DATA	06 - TEST REPORTS	07 - CERTIFICATES	08 - MFRS INSTRUCTIONS	09 - MFRS FIELD REPORT	10 - O&M DATA	11 - CLOSEOUT SUBMITTALS	FO - FOR INFORMATION ONLY	GA - GOVERNMENT APPROVED	DA - DESIGNER OF RECORD APPROVAL	CR - CONFORMANCE REVIEW	DA / CR	DA / GA	DO - DISTRICT OFFICE	AO - AREA OFFICE	RO - RESIDENT OFFICE	PO - PROJECT OFFICE	DR - DESIGNER OF RECORD	AE - ARCHITECT / ENGINEER
00 72 00	52.236-13	Accident Prevention Plan	X													X				X					
00 73 00	1.11	Dev. From Accept. Design. No Deviation from Contract					X										X			X				X	
00 73 00	1.11	Dev. From Accepted Design - Deviates from Contract					X											X		X				X	
00 73 00	1.17	Supplemental Price Breakdown	X										X							X					
00 73 00	1.18	SSHO Qualifications	X											X						X					
01 10 00	5.2.3.1	(if concrete pavement) Joint Layout Plan with design drawings					X									X									
01 10 00	5.2	Building Envelope Sealing Performance Testing						X					X							X					
01 10 10	***	Tests as Req by Codes - DOR Develops Test Program						X						X						X			X		
01 10 00	5.8.3	BAS Review Information		X													X		X	X			X		
01 10 00	5.8.3	BAS Performance Verification Test						X						X						X			X		
01 10 00	5.8.4	Testing Adjusting and Balancing						X						X						X			X		
01 10 00	5.8.5	Commissioning						X						X						X			X		
01 10 00	6.15	Environmental As Required for Site Specific					X									X				X			X		
01 10 00	6.16	Permits as required for Site specific					X									X				X			X		
01 10 00	5.10.2	Fire Protection Tests						X	X				X							X			X		
01 32 01.00 1C	3.4.1	Preliminary Project Schedule	X												X					X					
01 32 01.00 1C	3.4.2	Initial Project Schedule	X												X					X					
01 32 01.00 1C	3.4.3	Design Package Schedule	X												X					X					
01 32 01.00 1C	3.6.1	Periodic schedule updates from the Contractor	X												X					X					
01 32 01.00 1C	3.7	Time Extension Request (Schedule)	X												X					X					
01 33 00	1.8	Submittal Register - DOR Input Required	X												X					X				X	
01 33 00	1.8	Submittal Register Updates (Design Packages, etc.)	X												X					X			X		
01 33 00	1.3.1	Substitution of Manuf or Model Named in Proposal		X	X												X			X			X		
01 33 16	1.2	Identify Designer(s) of Record	X												X					X					
01 33 16	1.1.2 / 3.2.4	Fast Track Design Package(s)					X									X			X	X					
01 33 16	1.2	Identification of all Designers of Record	X													X				X					
01 33 16	3.2.1	Site and Utility Des Package, incl. Substantiation					X									X			X	X					
01 33 16	3.2.2/3.5	Interim Des Subm Package(s), incl. Substantiation					X									X			X	X					
01 33 16	3.5.1	Drawings					X									X			X	X					
01 33 16	3.5.2.2	Sitework Design Analyses					X									X			X	X					
01 33 16	3.5.2.3	Structural Design Analyses					X									X			X	X					
01 33 16	3.5.2.4	Security Design Analyses					X									X			X	X					
01 33 16	3.5.2.5	Architectural Design Analyses					X									X			X	X					
01 33 16	3.5.2.6	Mechanical Design Analyses					X									X			X	X					
01 33 16	3.5.2.7	Life Safety Design Analyses					X									X			X	X					
01 33 16	3.5.2.8	Plumbing Design Analyses					X									X			X	X					
01 33 16	3.5.2.9	Elevator Design Analyses (as Applicable)					X									X			X	X					
01 33 16	3.5.2.10	Electrical Design Analyses					X									X			X	X					
01 33 16	3.5.2.11	Telecommunications Design Analyses					X									X			X	X					
01 33 16	3.5.2.12	Cathodic Protection Design Analyses					X									X			X	X					
01 33 16	3.5.3	Geotechnical Investigations and Reports					X									X			X	X					
01 33 16	3.5.4	LEED Submittals					X									X			X	X					
01 33 16	3.5.5	Energy Conservation Documentation					X									X			X	X					
01 33 16	3.5.6	Specifications					X									X			X	X					
01 33 16	3.5.7	Building Rendering					X									X			X	X					
01 33 16	3.2.4/3.7	Final Des Submittal Package(s), incl. Substantiation					X									X			X	X					
01 33 16	3.7.5	DD Form 1354 (Transfer of Real Property)										X				X				X					
01 33 16	3.2.5/3.8	Design Complete Submittal Package(s)					X									X			X	X					
01 33 16	3.3.3	Design and Code Review Checklists					X									X			X	X					
01 33 16	A-2.0	SID - Interim and Final (as applicable)			X	X	X								X					X					
01 33 16	B-2.0	FFE (as Applicable)					X								X					X					
01 45 04.00 1C	3.2	Design and Construction QC Plan	X													X				X					
01 57 20.00.10	1.2	Environmental Protection Plan	X													X				X					
01 78 02.00 1C	1.2.1	Final as-Built Drawings											X		X										
01 78 02.00 1C	1.2.7	Provide final as-built CADD and BIM Model files											X		X						X				
01 78 02.00 1C	1.2.9	Provide scans of all other docs in Adobe.pdf format											X		X						X				
01 78 02.00 1C	1.3.1	Equip-in-Place list of all installed equip and cost											X		X						X				
01 78 02.00 1C	1.3.2	Data on equip not addressed in O&M manuals											X		X						X				
01 78 02.00 1C	1.3.3	Final as-built specs - electronic files											X		X						X				
01 78 02.00 1C	1.4.2.1	Warranty management plan - FAR 52.246-21											X		X						X				
01 78 02.00 1C	1.4.2.1	Certificates of Warranty for extended warranty items											X		X						X				
01 78 02.00 1C	1.4.2.1	Contractor's POCs for implementing warranty process											X		X						X				
01 78 02.00 1C	1.4.2.1	List of each warranted equip, item, feature or system											X		X						X				
01 78 02.00 1C	1.5	See also Section 01 10 00 par. 5.8.4 and 5.8.5											X		X						X				
01 78 02.00 10	1.6.1.2	Equipment O&M Manuals - 1 electronic / 2 hard copies											X		X						X				
01 78 02.00 10	1.7	Field Training DVD Videos										X		X							X				
01 78 02.00 10	1.8	Pricing of CF/CI and GF/CI Property											X	X							X				
01 78 02.00 1C	1.11	List of Completed Cleanup Items											X				X				X				



SECTION 15195

WATER METERS

PART 1      GENERAL

.01      SCOPE

- A.      Water meters, sub-meters, and fire service meters.

.02      SUBMITTALS

- A.      Conform to requirements of Section 01300 - Submittals.
- B.      Submit written certification of calibration and test results.
- C.      Submit manufacturer's certification that water meters meet applicable requirements of this Specification Section.
- D.      Submit accuracy registration test certification from manufacturer for each 3-inch through 10 inch diameter meter.

.03      QUALITY CONTROL

- A.      Submit manufacturer's warranty against defects in materials and workmanship for one (1) year from date of Substantial Completion.
- B.      Provide vendor's unconditional guarantee that performance of each meter meets applicable AWWA standards and AWWA Manual M6 as follows:
  - 1. Displacement type: 10 years from installation or register registration shown below, whichever comes first.

Size (inch)	Registration (million gallons)
5/8,3/4	1.5
1	2.5
1-1/2	5.0
2	10.5
  - 2. Turbine type: 1 year from date of installation.
  - 3. Compound type: 1 year from date of installation.
  - 4. Fire service type: 1 year from date of installation,

Operations of hermetically sealed register, 5/8-inch to 2-inch diameter, shall be unconditionally guaranteed for 15 years.



- C. Provide manufacturer's unconditional guarantee for each sealed register against leakage, fogging, discoloration and stoppage for 15 years from date of Installation.
- D. Vendor may replace meters that become defective within guarantee period with meters that comply with this Specification. AWS will return defective meters to vendor at expense. Meters repaired or replaced under this guarantee must meet accuracy limits for new meters upon receipt and accuracy limits for remaining period of initial guarantee.

#### .04 METER LOCATION REQUIREMENTS

- A. Install 2-inch and smaller water meters and shut-off valves (stop boxes) at point of demarcation or as close to point of demarcation as physically possible.
- B. Meters shall not be placed inside of government owned facilities. Meters located within buildings shall remain as government property and maintenance and operation of these meters shall remain the responsibility of the government.

### PART2 PRODUCTS

#### .01 GENERAL

- A. Provide meters of type and size as indicated on Drawings, unless otherwise indicated.
- B. Provide bolted split casings. Main casings of meters and external fasteners: Copper alloy with minimum 75 percent copper for 5/8 inch to 2 inches, bronze or cast iron, hot-dipped galvanized or epoxy coating for 3 inches and larger.
- C. Straightening Vanes: Non-corrosive material compatible with case material.
- D. Intermediate gear train shall not come into contact with water and shall operate in suitable lubricant.
- E. Registers: Automatic Meter Reading (AMR) type that provides pulse, contact closure, piezo switch or encoder generated output signal, compatible with AWS radio and telephone AMR systems. Provide minimum 12-foot wire when permanently connected to register. Lens:



impact resistant. Register box: tamper resistant by means of tamper screw or plug: Register: permanently sealed, straight-reading, center-sweep test hand, magnetic driven, U.S. gallons. Digits: 6, black in color, with lowest registering 3 digits (below 1,000-gallon registration) having contrasting digit and background color. Register capacity of meters: 9.99 million gallons for 5/8 inch to 2 inches and 999.999 million gallons for 3 inches and larger.

- F. Connections: 5/8 inch to 1 inch: threads at each end; 1-1/2 to 2 inches: 2-bolt oval flanges each end; 3 inches and larger: flange at each end.
- G. Stamp manufacturer's meter serial number on outer case. Stamp manufacturer's meter serial number on outside of register lid when provided. Manufacturer's serial numbers shall be individual and not duplicated.
- H. Water Meters:

1) Provide approved meters equipped with AMR type register to connect to American Water AMR system. Water Meters less than 1 1/2" in size shall be: Neptune Model T10' (ProRead Gallon 6 wheel plastic bottom) with 'Neptune Model R900v2 – pit style MIU c/w 6-ft of antenna wire). **NO EXCEPTIONS**

Water Meter to be supplied with a 'McDonald' Cast Iron Yoke as shown on standard detail drawings for locations where directed by AW Project Manager.

2) Provide approved meters equipped with AMR type register to connect to American Water AMR system. Water Meters 1 1/2" and greater shall be Neptune HP Turbine meters with 'Neptune Model R900i – pit style MIU c/w 6-ft of antenna wire). **NO EXCEPTIONS**

Water Meter to be supplied with a 'McDonald' meter setter as shown on standard detail drawings for locations where directed by AW Project Manager

- I. Manufacturing Quality Control shall permit successful interchangeability from one meter to another of same size including registers, measuring chambers and units, discs or pistons as units, change gears, bolts, nuts, and washers without affecting accuracy of new meter.
- J. For water meter vaults provide vaults in accordance with requirements set forth in Specification Section 03500 – Valve Boxes and Meter Vaults.

## .02 METER APPLICATIONS

A. Sizes 5/8-inch to 2-inch Meters: Displacement type (except for constant flow where 2-inch turbine may apply).

B. Sizes 3-inch and above Meters:

### 1. Turbines:

Processing plants  
Manufacturing facilities  
Lawn sprinkler systems  
Effluent water in treatment plants  
Booster (pump) stations  
Level controlled tank filling operations  
Fire hydrants (transients)  
Inter-systems sale or transfer  
Sewer credit/sub-meter

### 2. Compounds:

Multi-family dwellings  
Motels and hotels  
Hospitals  
Schools  
Restaurants  
Office buildings  
Dormitories, nursing homes, department stores, shopping malls, and other commercial establishments

Note: Provide fire service type for sizes larger than 6 inches.

3. Fire Service Type: For designated fire protection lines. Provide proportional or compound type fire service meter assembly (AWWA C 703) when customer elects to use combination of potable and fire protection services in lieu of separate domestic meters and fire services.

## .03 MATERIALS

A. Cold-Water Meters:

1. Displacement Type: AWWA C 700; sizes 5/8 inch up to and including 2 inches; oscillating disc or piston of magnetic drive type; bolted split-case design, with either being removable.

2. Turbine Type: AWWA C 701; Class II; sizes 3 inches through 10 inches; flanged; straight-through measuring chamber; rotor construction: polypropylene or similar non rubber material with specific gravity of approximately 1.0, equipped with near frictionless replaceable bearings in turbine working against rotor shaft positioned thrust bearing. Transient/Fire Hydrant Meter Inlet: Female fitting for attachment to hose nozzle with National Standard Fire hose thread. Outlet: 2-inch nipple with National Pipe Thread. Include restriction plate to limit flow through meter to 400 gpm at 65 psi.
3. Compound Type: AWWA C 702; sizes 2 inches through 6 inches. Measuring chambers: For use in continuous operation; separate units of copper alloy (minimum 84 percent copper) or approved polymer material, inert in corrosive potable water; with centering device for proper positioning. Measuring pistons: Non-pilot type with division plates of rubber covering vulcanized to stainless steel or other approved material of sufficient thickness to provide minimum piston oscillation noise. Measuring discs: Flat or conical type, one piece, mounted on monel or 316 stainless steel spindle. Measuring chamber strainer screen area: Twice area of main case inlet.
4. Fire-Service Type: sizes 4 inches through 10 inches; turbine-type, compound type, proportional type; AWWA C 703, with separate check valve conforming to AWWA C 510. Determine size of fire meter by adding fire flow and domestic flow.

#### .04 STRAINERS

- A. Displacement Potable Water Meters 5/8 inch through 2 inches: Self-straining by means of annular space between measuring chamber and external case or with strainer screens installed in meter. Provide rigid screens which fit snugly, are easy to remove, with effective straining area at least double that of main case inlet.
- B. Potable Water Meters 2-inch diameter and larger: Equip with separate external strainer with bronze body for diameters less than 8 inches. 8-inch diameter and larger may be cast iron, hot-dipped galvanized or epoxy coating. Strainers: Bolted to inlet side of meter, detachable from meter, easily removable lid. Strainer screen: Made of rounded cast bronze, stainless steel wire, having nominal screen size of 3-1/2 mesh-per-inch (U.S. Series) not less than 45 percent clear area.
- C. Provide separate approved external strainers (when required by meter manufacturer) approved for use in fire service metered connections by Underwriters Laboratories. Bodies: Cast iron or copper alloy. Ends:



Flanged in accordance with ASME B 16.1, Class 125. Provide stainless steel basket. Strainers shall be detachable from meter.

#### .05 CONNECTIONS AND FITTINGS

- A. Provide pipe for connections in accordance with Section 02501 - Ductile Iron Pipe and Fittings and Section 02506 - Polyvinyl Chloride Pipe. Use restrained joints and flanged joints only.
- B. Fittings:
  - 1. For meters 2 inches and smaller: Same type of fittings as Outlet End fittings for Curb Stop in accordance with Section 15050 - Water Tap and Service Line Installation.
  - 2. For meters 3 inches and larger: Restrained ductile iron; push-on bell joints or mechanical joint fittings between water line and meter vault; Class 125 flanged inside meter vaults; cement mortar lined and sealed.

#### .06 LAYING LENGTHS

- A. Minimum laying lengths for meter and standard strainer shall be as shown on Drawings.

### **PART 3 EXECUTION**

#### .01 TAPPING AND METER SERVICE INSTALLATION

- A. Meter Service Line:
  - 1. Use pipe and fittings conforming to requirements of Section 15105 - Ductile Iron Pipe and Fittings, or Section 15120 - Polyvinyl Chloride Pipe.
  - 2. Limit pulling and deflecting of joints to limits recommended by manufacturer.
  - 3. Make vertical adjustments with offset bends where room will permit. Minimize number of bends.
  - 4. Provide minimum of ten pipe diameters of straight pipe length upstream and downstream of meter vault.



## .02 METER FITTING HOOKUP

- A. Support meter piping and meter, level and plumb, during installation. Support meters 3 inches and larger with concrete at minimum of two locations.
- B. Use round flanged fittings inside meter box or vault except for mechanical joint to flange adapter. Provide full-face 1/8-inch black neoprene or red rubber gasket material on flanged joints. Provide bolts and nuts made from approved corrosion-resistant material.
- C. Tighten bolts in proper sequence and to correct torque.
- D. Visually check for leaks under normal operating pressure following installation. Repair or replace leaking components.

## .03 METER BOX AND VAULT INSTALLATION

- A. Conform to requirements of Section 03500 - Valve Boxes and Meter Vaults.
- B. Perform adjustment to existing meter in accordance with Section 03500 - Valve Boxes and Meter Vaults.

## .04 TESTING

- A. Accuracy registration tests will be conducted in accordance with latest revision of AWWA standard for type and size of meter.
  - 1. Tests will be run by on meters prior to installation at AWS meter repair shop. Meters 2 inches and smaller will be tested at random at AWS discretion. All 3 inches and larger meters will be tested.





2. Accuracy of displacement meters during guarantee period shall be as follows:

- a. Initial period: of 18 months from date of shipment or 12 months from date of installation: 98.5% to 101.5% at standard and minimum flow rates; 98% to 101% at low flow rates.
- b. Second period: AWWA new meter accuracy as tested below.

Meter Size (inches)	<u>GUARANTEE PERIOD</u>		<u>TEST FLOW RATE</u>
	Age of Meter (Years) Or	Million* Gallons	Minimum Rate (gpm)
5/8	>1 to <5	0.5	1/4
1	>1 to <5	1.0	3/4
1-1/2	>1 to <5	2.5	1-1/2
2	>1 to <5	5.5	2

\* Total registration.

- c. Third period: AWWA new meter accuracy for standard flow rates and AWWA repair meter accuracy for minimum flow rate as tested below.

Meter Size (inches)	<u>GUARANTEE PERIOD</u>		<u>TEST FLOW RATE</u>
	Age of Meter (Years) Or	Million* Gallons	Minimum Rate (gpm)
5/8	>5 to <10	1.5	1/4
1	>5 to <10	2.5	3/4
1-1/2	>5 to <10	5.0	1-1/2
2	>5 to <10	10.0	2

3. Minimal acceptable accuracy in percent of low flow registration for turbine meters:

<u>Meter Size</u> <u>(inches)</u>	<u>Minimum Flow</u> <u>(gpm)</u>	<u>% Accuracy</u> <u>Required</u>
2	3	95
3	5	95
4	15	95
6	20	95
8	20	95
10	30	95

**END OF SECTION 15195**

# Water Meters and Accessories H-1

## 800-EJP-24 HR

# Invensys SR® Water Meters

## 5/8" thru 2" SR® ECR Meters



Each ECR (Electronic Communications Register) contains an electronic chip for transmitting meter reading data to a remote TouchPad which, on command, transfers to a TouchRead® System reading gun. A built-in odometer and low flow (leak) detector enable the ECR to also be read visually, if required. ECR registers are fully compatible with centralized automatic meter reading, for installations today or for future conversions.

### NOTES:

- Refer to page H-2 and H-3 water meter parts and accessories .
- See pages H-24 and H-25 for Meter Guarantee.

METER SIZE	PRODUCT NUMBER			
	REGISTRATION			
	10 CF	100 CF	100 G	1000 G
5/8"	50016 1	50023	50027	50028
5/8" x 3/4"	50047 1	50047	50051 2	50052
3/4"	—	50133	—	50134
1"	—	50152	—	50152 1
METER SIZE	REGISTRATION			
	100 CF	1000 CF	1000 G	10,000 G
	100 CF	1000 CF	1000 G	10,000 G
1 1/2"	50222 17	50223	50226 11	50228
2"	50243 2	50245 2	50251 28	50251 1

### SHORT SPEC:

Must conform to AWWA C-700 as most recently revised. All meters shall have a non-corrosive waterworks bronze outer case with a separate oscillating piston type measuring chamber which can easily be removed from the case. All meters shall have cast on them, in raised characters, the size and direction of flow through the meters. Cast iron frost bottoms shall be provided on 5/8", 3/4" and 1" meters. 1 1/2" and 2" meters shall be of the split case type with bronze lower and upper shell assemblies. All external bolts and washers shall be of corrosion resistant materials. Meters shall conform to AWWA new meter accuracy standards for a period of one year and to at least repaired meter standards for a period of fifteen (15) years.\*

\* See page H-24 for bronze-clad guarantee.

## 5/8" thru 2" SR® ECR Meter Selection Guide

METER SIZE	A	B	C	WIDTH	PIPE THREADS	OPERATING RANGE *	NET WEIGHT
5/8"	7 1/2"	4 9/16"	2 1/8"	4 5/8"	3/4"	1/4 - 20 gpm.	5 lbs. 9 ozs.
5/8" x 3/4"	7 1/2"	4 9/16"	2 1/8"	4 5/8"	1"	1/4 - 20 gpm.	5 lbs. 9 ozs.
3/4"	9"	5 1/8"	2 9/32"	5 1/4"	1"	1/2 - 30 gpm.	8 lbs. 0 ozs.
1"	10 3/4"	5 3/4"	2 5/8"	6 13/16"	1 1/4"	3/4 - 50 gpm.	12 lbs. 0 ozs.
1 1/2"	13"	6 7/8"	2 21/32"	8 3/4"	Flanged	1 1/2 - 100 gpm.	26 lbs. 0 ozs.
2"	17"	7 11/32"	2 5/8"	9 11/16"	Flanged	2 - 160 gpm.	42 lbs. 0 ozs.

\* Maximum continuous flow rates as specified by AWWA are 1/2 the maximum flows listed.

**Ask your EJP Rep.  
for a Meter Demonstration**



## Intermediate and Large Capacity Diaphragm Type Gas Meters







## Intermediate and Large Capacity Diaphragm Gas Meters

### Single Joint Large Capacity Meters

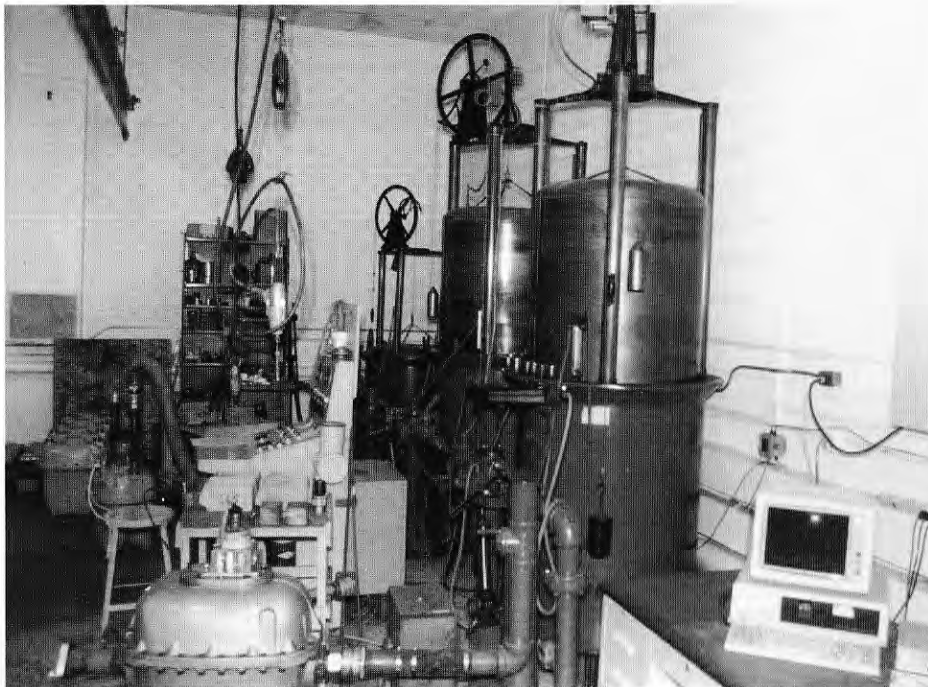
The recognized quality of today's Sensus meters is the result of 100 years of methodical research and evolutionary development, implemented by an up-to-the-minute production team.

All Sensus Diaphragm meters, including the lightweight large capacity models, are designed around our unique Single Joint Concept — a single seal joining upper and lower halves of the meter body and incorporating the valve plate area. Coupled with complete interchangeable valve plate assemblies and lightweight aluminum bodies, this design offers several important benefits.

- Ease of repair
- Replaceability of measurement module
- Simple installation
- Lighter weight, for ease of handling and lower shipping costs
- Minimal risk of leakage — because there's only 1 body seal

Only Sensus Metering Systems offers you all these cost-saving benefits in a complete line of Single Joint meters made of Corrosion-resistant Aluminum Alloy Castings.

Compare the features of Sensus meters with any others made. See for yourself why Sensus large capacity meters are one of today's outstanding meter values.



**The full selection available in Sensus Metering Systems complete line of single joint large capacity gas meters assures you the right meter for any application.**

### 10,000 Meter

The rugged 10,000 meter, with "O" ring seal, is the largest among the Sensus line of single joint aluminum gas meters.

This lightweight, large capacity meter, made of aluminum alloy, has a maximum working pressure of 100 psig, yet weighs only 428 pounds—about one-third the weight of comparable cast iron meters.

Its rigid construction and light weight make it the perfect meter for commercial and industrial operations requiring large volume loads at high pressure.



10,000 Meter

### 3000 Meter

The sturdy design, internally and externally, of the Sensus 3000 meter makes it ideal for commercial and industrial operations where large volume loads at high pressure (up to 100 psig) are necessary.

Single joint construction and "O" ring type gasket insure a positive seal against leakage.

Aluminum alloy construction of the cover, body, and valve plate accounts for its lightweight durability and economy in shipping costs.

Compact, 28 1/4" x 16" wide, and weighing approximately 100 pounds, the 3000 meter eliminates many of the service and installation problems encountered with the heavier cast iron meters.



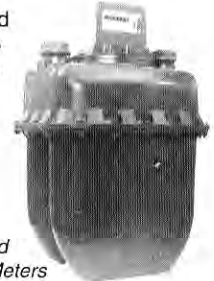
3000 Meter

### 750 and 1600 Meters

The 750 and 1600 meters, like all Sensus single joint lightweight meters, are extremely versatile because repair and space problems are reduced to a minimum. Due to advanced design and engineering features, both of these meters have all of the inherent simplicity and accuracy of the reputable Sensus single joint meters.

The 1600 is constructed of sturdy aluminum alloy castings. It has an "O" ring seal and is especially suited to small industrial and commercial operations where large capacities at high pressure are needed.

Guide wires are utilized in the 750 and 1600 to provide the smoothest possible diaphragm motion and to assure proof stability and long meter life.



750 and  
1600 Meters

### 5000 Meter

The great weight reduction over previous cast iron models, made possible by the use of aluminum alloy for the cover, body, and valve plate, results in substantial savings in shipping costs as well as greater ease in handling.

To prevent leakage between the body and cover, the 5000 meter has an "O" ring seal.

Its compact design and light weight make this meter an ideal replacement for large tin meters still in service, and for downtown basement installations where a large capacity, yet easy-to-handle, meter is required.



5000 Meter

### 1000 Meter

The 1000 meter, newest member of the single joint line of meters, was engineered for intermediate size loads on commercial and industrial services. It was designed and built specifically for 1000 cfh loads—not an alteration or redesign of an existing meter.

The low speed (1.6 REV/CF) of the 1000 meter ensures proof stability and long service life with minimum maintenance.

This meter, as well as all others described on this page, incorporates such recognized Equimeter features as single joint and low friction valves.

The 1000 meter, as well as all the other members of the single joint family, makes use of modern engineering plastic (UV stabilized clear polycarbonate) for its index box as standard equipment.

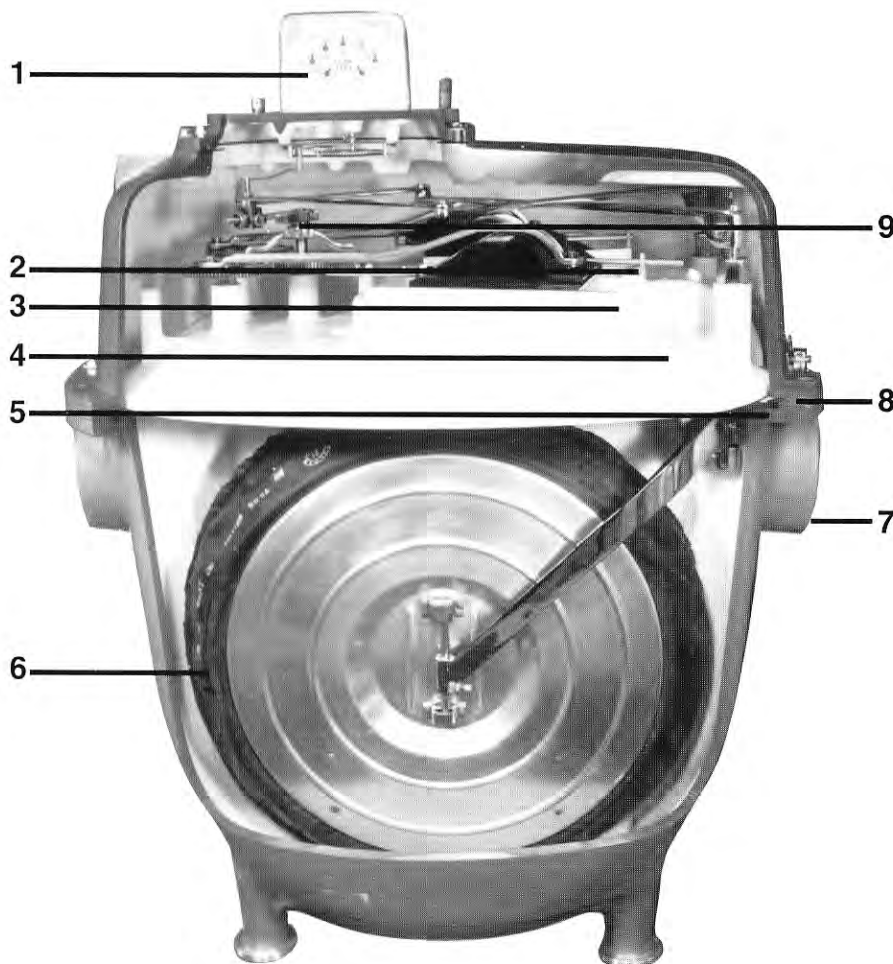


1000 Meter



Intermediate and Large Capacity  
Diaphragm Gas Meters

**Sensus Single Joint Meters are Engineered  
For Accuracy, Dependability, and Economy.  
How? Check these Features . . .**



## **1 UV STABILIZED CLEAR POLYCARBONATE INDEX BOX**

high impact engineering materials reduce  
tampering and vandalism.

## **2 ACETAL VALVE GUIDES**

minimize friction.

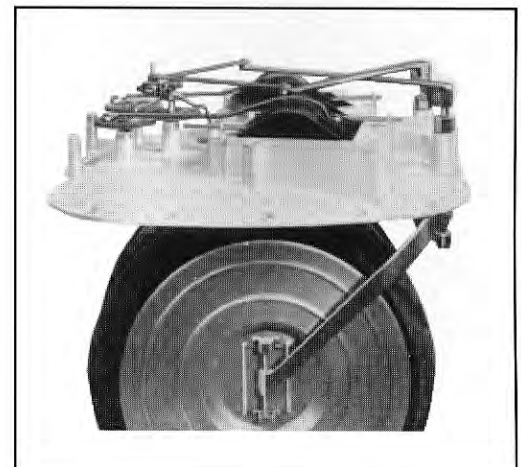
## **3 TEFLON-FACED BAKELITE VALVES**

minimize friction.

## **4 INTERCHANGEABLE VALVE PLATE ASSEMBLY**

All Sensus aluminum case meters are  
designed with all moving and working parts  
located on a single aluminum alloy valve  
plate casting. This gives two important  
advantages:

1. Proper alignment of the working  
parts is insured with resultant main-  
tenance of accuracy;
2. The working parts of the meter can  
easily be removed for inspection,  
repair, and calibration.



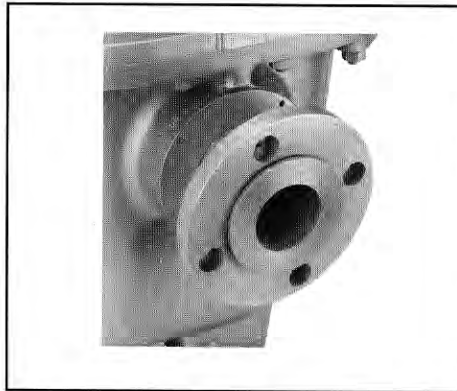
## 5 "O" RING SEAL

One of the most important features of the 1600, 3000, 5000 and 10,000 large capacity meters is the use of the "O" ring type gasket. This Buna-N gasket fits snugly into a groove machined into the top of the Sensus meter body, thereby insuring a positive seal against leakage between the cover and body.



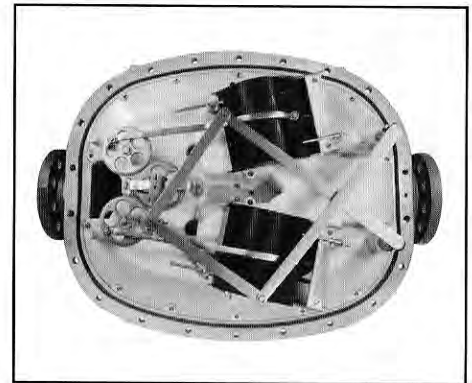
## 7 INSERTED STEEL UNIVERSAL CONNECTIONS

The 3000, 5000 and 10,000 large capacity meters have threaded steel inserts in the inlet and outlet connections as a replaceable part of the body casting. These steel inserts furnish extremely strong, corrosion-resistant connections which afford a minimum of friction and complete freedom from seizure. Heavy duty steel flanges are also available on all Sensus large capacity meters.



## 9 POWDERED METAL PARTS

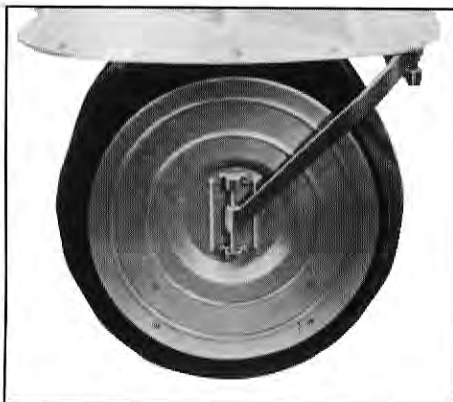
The use of oil impregnated powdered metal bushings and bearings at all potential wear points and the use of powdered metal timing gears for maintaining the relationship between the valves, are instrumental in keeping friction to a minimum and assuring a smooth glide for the Bakelite valves used in all Sensus single joint meters.



■ Temperature compensation is available on all diaphragm meters.

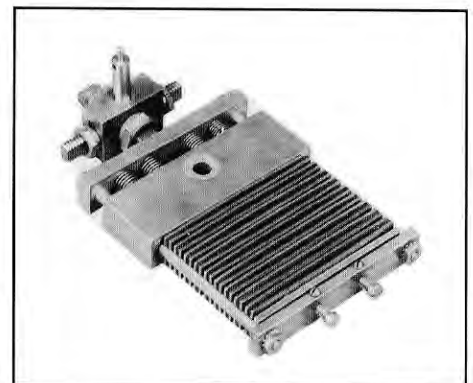
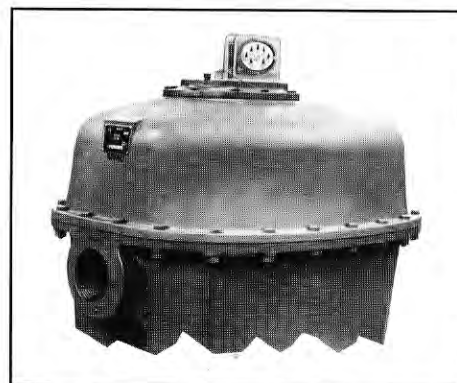
## 6 SYNTHETIC DIAPHRAGMS

Specially treated synthetic material. Field tested for over 25 years.



## 8 SINGLE JOINT CONSTRUCTION

Single joint construction—cover to body for ease of repair—is an exclusive feature found only in lightweight meters and offers the advantage of having only one main gasket joint to seal... competitive meters have as many as six external gasket joints.



■ Internal relief valves are available on the 5000 and 10,000 large capacity meters.

■ If required, all large capacity meter covers can be supplied with 1" tapping for easy temperature bulb insertion.





## Intermediate and Large Capacity Diaphragm Gas Meters

### Sensus Gas Meter Capacity Tables

Some care must be taken in establishing diaphragm meter capacities, and the tables on this and the following page are designed to simplify meter sizing. The first table lists the natural gas capacities of Sensus diaphragm meters at base pressure conditions and at meter differentials of both  $\frac{1}{2}$ " w.c. and 2" w.c., which is the most common method of presenting such information. The other tables give meter capacities at elevated operating pressures and for several commonly metered gases in addition to natural gas. Diaphragm capacities under pressure must be suppressed from the normal Boyle's law multipliers somewhat to protect the meter diaphragms from damage. These tables do just that and indicate the maximum allowable capacity for each meter under various pressure and gas conditions for safe, reliable operation. Also listed are capacities limiting the meter differential to 2" w.c. because a number of utilities place that restriction on their use to extend ultimate meter life. For meter capacities at other pressures and for gases other than those listed, please contact your local Sensus representative.

**NOTE:** Recommended meter operating temperature range is -30°F to +150°F. The typical temperature compensation performance is within an accuracy band of  $\pm 2\%$  over a flowing gas temperature range of -20°F to +120°F.

### NATURAL GAS CAPACITIES

Meter Model	Capacity Rating @ $\frac{1}{2}$ " w.c. Differential	Capacity Rating @ 2" w.c. Differential
750	750 CFH	1600 CFH
1600	800	1600
1000	1000	2200
3000	1450	3000
5000	2500	5000
10000	5000	10000

Note: Capacities based on 0.6 sp. gr. gas metered at 4 oz. base pressure.

*The table below can be used to estimate capacities at other elevated pressures. Multiply the maximum allowable factor, or the 2" w.c. factor corresponding to the operating pressure, times the 2" w.c. rating at 0.25 psig.*

*Example: A 3000 meter operating at 100 psig has a maximum allowance capacity of:*

$$(4.50) \times (3000) = 13,500 \text{ SCFH.}$$

*The same meter at 50 psig has a 2" w.c. capacity of:*

$$(2.10) \times (3000) = 6,300 \text{ SCFH.}$$

*Please see the Sensus Gas Meter Capacity Tables section for additional details.*

### CAPACITIES AT OTHER ELEVATED PRESSURES

Gauge Pressure (psig)	Maximum Allowance Factor	2" w.c. Factor
0	1.00	1.00
5	1.29	1.15
10	1.55	1.30
15	1.78	1.45
20	2.00	1.55
25	2.23	1.65
30	2.40	1.75
40	2.78	1.95
50	3.10	2.10
60	3.50	2.30
70	3.73	2.40
75	3.80	2.50
80	4.00	2.60
90	4.30	2.70
100	4.50	2.80

### NATURAL GAS CAPACITIES SCFH OF 0.6 SP. GR. GAS AT ELEVATED PRESSURES

Gauge Pressure (psig)	Diff.	750	1600	1000	3000	5000	10,000
0.25	2" w.c.	1,600	1,600	2,200	3,000	5,000	10,000
	Max. Allow.	1,600	1,600	2,200	3,000	5,000	10,000
5	2" w.c.	1,840	1,840	2,530	3,450	5,750	11,500
	Max. Allow.	2,070	2,070	2,840	3,880	6,450	12,900
10	2" w.c.	2,080	2,080	2,860	3,900	6,500	13,000
	Max. Allow.	2,480	2,480	3,420	4,660	7,760	15,550
15	2" w.c.	2,320	2,320	3,190	4,350	7,250	14,500
	Max. Allow.	2,840	2,840	3,960	5,400	9,000	18,000
20	2" w.c.	2,480	2,480	3,410	4,650	7,750	15,500
	Max. Allow.	3,230	3,230	4,440	5,820	10,100	20,200
25	2" w.c.		2,640	3,630	4,950	8,250	16,500
	Max. Allow.		3,570	4,900	6,700	11,100	22,300
40	2" w.c.		3,120		5,850	9,750	19,500
	Max. Allow.		4,450		8,700	13,900	27,800
50	2" w.c.		3,360		6,300	10,500	21,000
	Max. Allow.		5,000		9,370	15,600	31,200
70	2" w.c.		3,840		7,200	12,000	24,000
	Max. Allow.		5,980		11,200	18,700	37,400
100	2" w.c.		4,480		8,400	14,000	28,000
	Max. Allow.		7,170		13,400	22,400	44,800

All capacities listed are standard cubic feet per hour, standard conditions being an atmospheric pressure of 14.4 psia and 60°F with a 4 oz. base pressure. Tables do not take into account supercompressibility. Last capacity figure in each group indicates maximum allowable operating pressure. See specification table on page 10.

### METRICATION Use the following for metric conversions:

$$\text{std. metres}^3/\text{hr.} \times 35.31 = \text{std. ft}^3/\text{hr. (SCFH)}$$

$$\text{std. ft}^3/\text{hr. (SCFH)} \times 0.0283 = \text{std. metres}^3/\text{hr.}$$

$$\text{kilograms/centimeter}^2 \text{ (kg/cm}^2\text{)} \times 14.22 = \text{psi}$$

$$\text{psi} \times 0.0703 = \text{kilograms/centimeters}^2 \text{ (kg/cm}^2\text{)}$$

$$\text{kilopascals (kPa)} \times 0.145 = \text{psi}$$

$$\text{psi} \times 6.90 = \text{kilopascals (kPa)}$$

$$\text{bars} \times 14.50 = \text{psi}$$

$$\text{psi} \times 0.069 = \text{bars}$$

$$\text{millimeters water (mm H}_2\text{O)} \times 0.0394 = \text{in. w.c.}$$

$$\text{in. w.c.} \times 25.4 = \text{millimeters water (mm H}_2\text{O)}$$

$$\text{millimeters mercury (mm Hg)} \times 0.535 = \text{in. w.c.}$$

$$\text{in. w.c.} \times 1.868 = \text{millimeters mercury (mm Hg)}$$



**ARGON—  
SPECIFIC GRAVITY 1.38  
PROPYLENE—SPECIFIC GRAVITY 1.45**

Gauge Pressure (psig)	Meter Diff.	750	1600	1000	3000	5000	10,000
0.25	2" w.c.	1,070	1,070	1,470	2,010	3,350	6,700
	Max.	1,390	1,390	1,910	2,610	4,350	8,700
5	2" w.c.	1,220	1,220	1,670	2,280	3,800	7,600
	Max.	1,710	1,710	2,350	3,210	5,350	10,700
10	2" w.c.	1,380	1,380	1,890	2,580	4,300	8,600
	Max.	2,020	2,020	2,770	3,780	6,300	12,600
15	2" w.c.	1,520	1,520	2,090	2,850	4,750	9,500
	Max.	2,260	2,260	3,100	4,230	7,050	14,100
20	2" w.c.	1,630	1,630	2,240	3,060	5,100	10,200
	Max.	2,500	2,500	3,430	4,680	7,800	15,600
25	2" w.c.	1,780	2,440	3,330	5,550	11,100	
	Max.	2,770	3,810	5,190	8,650	17,300	
40	2" w.c.	2,080		3,900	6,500	13,000	
	Max.	3,330		6,240	10,400	20,800	
50	2" w.c.	2,290		4,290	7,150	14,300	
	Max.	3,650		6,840	11,400	22,800	
70	2" w.c.	2,690		5,040	8,400	16,800	
	Max.	4,290		8,040	13,400	26,800	
100	2" w.c.	3,040		5,700	9,500	19,000	
	Max.	5,120		9,600	16,000	32,000	

**PROPANE and  
DRY CARBON DIOXIDE  
SPECIFIC GRAVITY 1.55**

Gauge Pressure (psig)	Meter Diff.	750	1600	1000	3000	5000	10,000
0.25	2" w.c.	990	990	1,360	1,860	3,100	6,200
	Max.	1,340	1,340	1,850	2,520	4,200	8,400
5	2" w.c.	1,120	1,120	1,540	2,100	3,500	7,000
	Max.	1,630	1,630	2,240	3,060	5,100	10,200
10	2" w.c.	1,260	1,260	1,740	2,370	3,950	7,900
	Max.	1,920	1,920	2,640	3,600	6,000	12,000
15	2" w.c.	1,390	1,390	1,910	2,610	4,350	8,700
	Max.	2,180	2,180	2,990	4,080	6,800	13,600
20	2" w.c.	1,550	1,550	2,130	2,910	4,850	9,700
	Max.	2,420	2,420	3,320	4,530	7,550	15,100
25	2" w.c.	1,620	2,220	3,030	5,050	10,100	
	Max.	2,610	3,590	4,890	8,150	16,300	
40	2" w.c.	1,920		3,600	6,000	12,000	
	Max.	3,140		5,880	9,800	19,600	
50	2" w.c.	2,110		3,960	6,600	13,200	
	Max.	3,470		6,510	10,850	21,700	
70	2" w.c.	2,400		4,500	7,500	15,000	
	Max.	4,100		7,680	12,800	25,600	
100	2" w.c.	2,800		5,250	8,750	17,500	
	Max.	4,830		9,060	15,100	30,200	

**AIR, DRY CARBON MONOXIDE,  
ETHANE, NITROGEN, ETHYLENE—  
SPECIFIC GRAVITY 1.0**

Gauge Pressure (psig)	Meter Diff.	750	1600	1000	3000	5000	10,000
0.25	2" w.c.	1,220	1,220	1,670	2,280	3,800	7,600
	Max.	1,500	1,500	2,060	2,800	4,670	9,350
5	2" w.c.	1,440	1,440	1,980	2,700	4,500	9,000
	Max.	1,840	1,840	2,530	3,450	5,750	11,500
10	2" w.c.	1,620	1,620	2,220	3,030	5,050	10,100
	Max.	2,240	2,240	3,080	4,200	7,000	14,000
15	2" w.c.	1,780	1,780	2,440	3,330	5,550	11,100
	Max.	2,510	2,510	3,450	4,710	7,850	15,700
20	2" w.c.	1,920	1,920	2,640	3,600	6,000	12,000
	Max.	2,800	2,800	3,850	5,250	8,750	17,500
25	2" w.c.	2,080	2,860	3,900	6,500	13,000	
	Max.	3,020	4,160	5,670	9,450	18,900	
40	2" w.c.	2,480		4,650	7,750	15,500	
	Max.	3,840		7,200	12,000	24,000	
50	2" w.c.	2,640		4,950	8,250	16,500	
	Max.	4,190		7,860	13,100	26,200	
70	2" w.c.	3,040		5,700	9,500	19,000	
	Max.	5,120		9,600	16,000	32,000	
100	2" w.c.	3,490		6,540	10,900	21,800	
	Max.	5,920		11,100	18,500	37,000	

**HYDROGEN—SPECIFIC GRAVITY 0.069\*†**

Gauge Pressure (psig)	Meter Diff.	750	1600	1000	3000	5000	10,000
0.25	Max.	1,600	1,600	2,200	3,000	5,000	10,000
5	Max.	2,110	2,110	2,900	3,960	6,600	13,200
10	Max.	2,640	2,640	3,630	4,950	8,250	16,500
15	Max.		3,180	4,380	5,970	9,950	19,900
20	Max.		3,710		6,960	11,600	23,200
25	Max.		4,260		7,980	13,300	26,600
40	Max.		5,860		10,980	18,300	36,600
50	Max.		6,980		13,080	21,800	43,600

**HELIUM—SPECIFIC GRAVITY 0.138\*†**

Gauge Pressure (psig)	Meter Diff.	750	1600	1000	3000	5000	10,000
0.25	Max.	1,600	1,600	2,200	3,000	5,000	10,000
5	Max.	2,110	2,110	2,900	3,960	6,600	13,200
10	Max.	2,640	2,640	3,630	4,950	8,250	16,500
15	Max.		3,180	4,380	5,970	9,950	19,900
20	Max.		3,710		6,960	11,600	23,200
25	Max.		4,260		7,980	13,300	26,600
40	Max.		5,860		10,980	18,300	36,600
50	Max.		6,980		13,080	21,800	43,600

\* These gases are quite light compared to natural gas and, therefore, meter differentials at maximum capacities are less than 2" w.c. in most cases.

† Because of low density, meter pressure ratings are reduced 50% to eliminate potential leakage.

**BUTANE—SPECIFIC GRAVITY 2.08**

Gauge Pressure (psig)	Meter Diff.	750	1600	1000	3000	5000	10,000
0.25	2" w.c.	860	860	1,190	1,620	2,700	5,400
	Max.	1,230	1,230	1,690	2,310	3,850	7,700
5	2" w.c.	990	990	1,360	1,850	3,080	6,160
	Max.	1,500	1,500	2,070	2,820	4,700	9,400
10	2" w.c.	1,130	1,130	1,550	2,110	3,520	7,050
	Max.	1,740	1,740	2,400	3,270	5,450	10,900
15	2" w.c.	1,260	1,260	1,730	2,360	3,940	7,880
	Max.	1,970	1,970	2,710	3,690	6,150	12,300
20	2" w.c.	1,360	1,360	1,870	2,550	4,250	8,500
	Max.	2,160	2,160	2,970	4,050	6,750	13,500
25	2" w.c.		1,470	2,020	2,760	4,600	9,200
	Max.		2,400	3,300	4,500	7,500	15,000
40	2" w.c.		1,760		3,300	5,500	11,000
	Max.		2,800		5,250	8,750	17,500
50	2" w.c.		1,840		3,450	5,750	11,500
	Max.		3,100		5,820	9,700	19,400
70	2" w.c.		2,100		3,930	6,500	13,100
	Max.		3,600		6,750	11,250	22,500
100	2" w.c.		2,400		4,500	7,500	15,000
	Max.		4,160		7,800	13,000	26,000



## Intermediate and Large Capacity Diaphragm Gas Meters

### Meter Mounted Instruments

All Sensus meters are volumetric devices which totalize volume at line conditions. Meter accessories are available to provide read-outs in desired units at line conditions or corrected for pressure, temperature or both. These accessories fit directly on the index plate without special adapters and are provided with weather-proof cases. Read-out units can be in either cubic feet or cubic meters.

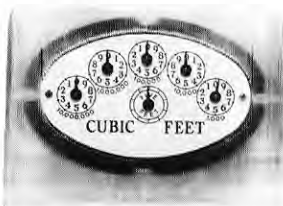
Sensus Meter Mounted Vertical Direct Reading indexes in aluminum boxes and all electronic correcting instruments can be equipped to provide intrinsically safe pulse outputs for remote reading. Electronic correctors can provide remote reading of either or both uncorrected and corrected volumes. Remote readouts can be obtained in either cubic feet or metric units.

### Indexes

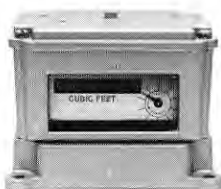
Circular Reading (VCR) and Direct Reading (VDR) indexes are housed in Lexan covers. The VDR index is also available in an aluminum box with a switch output to transmit totalized volume to a remote counter or instrument.



Direct Reading (VDR) Index



Circular Reading (VCR) Index



Aluminum Box Direct Reading (VDR) Index

### Industrial Gas Measurement

Industry today is placing a tremendous amount of emphasis on fuel conservation and fuel allocation within its facilities. Plant accountants are making efforts to keep increasingly accurate records of fuel gas consumption as well as consumption of various special process gases within their facilities. Sensus' complete line of single joint large capacity diaphragm meters provides industry with the metering equipment they need to do the job and to do it accurately. Listed below are some of the gases used by industry that Sensus meters are capable of handling. See pages 6 and 7 of this bulletin for capacity information and see your local Sensus representative or distributor for further information regarding in-plant metering and special gas services. Sensus diaphragm meters offered for these services are of standard construction. These meters will provide accurate measurement and normal meter life. They will not create any hazards when used with the listed gases. The materials of construction in these standard meters are compatible with the listed gases and no material breakdown will occur when contacting these gases.

Some contamination of metered gases may occur due to petroleum base lubricants used in the meters.

#### Gas

Air
Argon (Ar)
Butane (C <sub>4</sub> H <sub>10</sub> )
Carbon Dioxide (CO <sub>2</sub> )*
Carbon Monoxide (CO)*
Ethane (C <sub>2</sub> H <sub>6</sub> )
Ethylene (C <sub>2</sub> H <sub>4</sub> )
Helium (He)†
Hydrogen (H <sub>2</sub> )†
Krypton (Kr)
Methane (CH <sub>4</sub> )
Nitrogen (N <sub>2</sub> )
Neon (Ne)
Pentane (C <sub>5</sub> H <sub>12</sub> )
Propane (C <sub>3</sub> H <sub>8</sub> )
Propylene (C <sub>3</sub> H <sub>6</sub> )
Xenon (Xe)

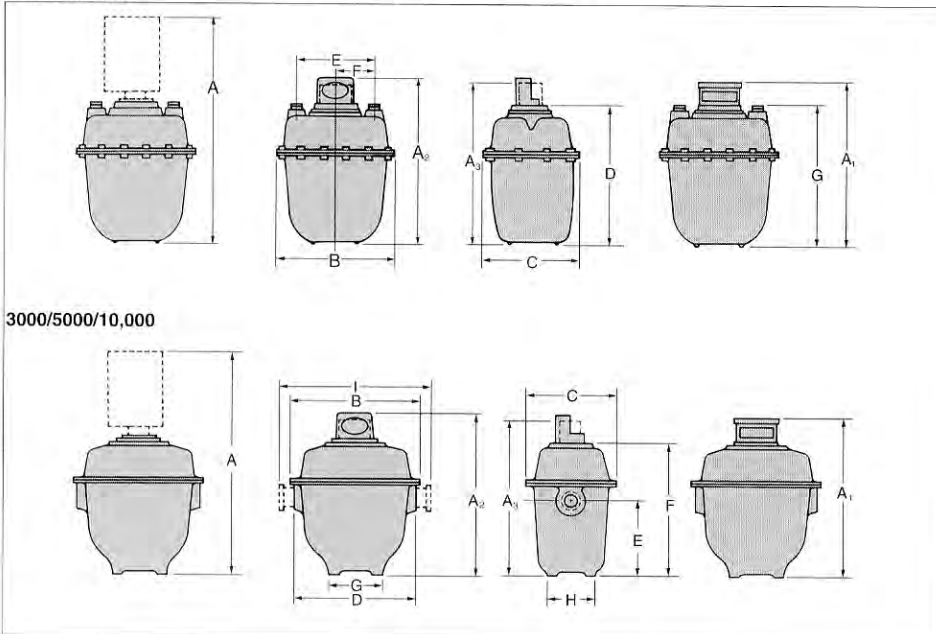
\* Gas must be 100% dry.

† Because of the low density of these gases, meters for this service may not be used in excess of 50% of their pressure rating.

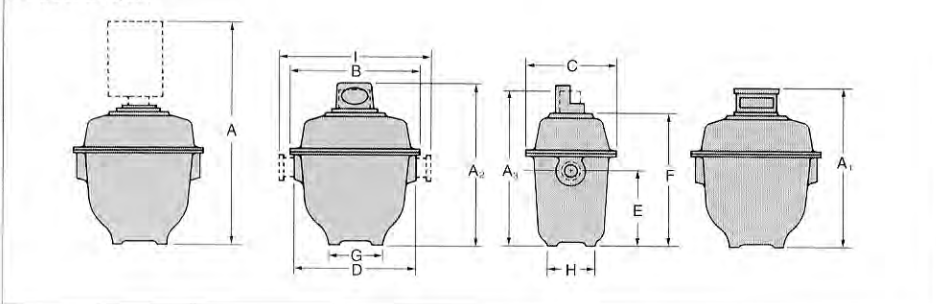
## Intermediate and Large Capacity Diaphragm Gas Meters

### Comparative Dimensions of Sensus Large Capacity Meters. . .

750/1600/1000



3000/5000/10,000



### 750/1600/1000 Meters

Dimensions (Inches)	750	Model 1600	1000
A	32 <sup>3</sup> / <sub>4</sub>	32 <sup>3</sup> / <sub>4</sub>	35 <sup>3</sup> / <sub>8</sub>
A <sub>1</sub>	23 <sup>3</sup> / <sub>8</sub>	23 <sup>3</sup> / <sub>8</sub>	26
A <sub>2</sub>	24 <sup>3</sup> / <sub>16</sub>	24 <sup>3</sup> / <sub>16</sub>	26 <sup>7</sup> / <sub>8</sub>
A <sub>3</sub>	22 <sup>7</sup> / <sub>8</sub>	22 <sup>7</sup> / <sub>8</sub>	25 <sup>1</sup> / <sub>2</sub>
B	17 <sup>1</sup> / <sub>4</sub>	17 <sup>1</sup> / <sub>4</sub>	19 <sup>1</sup> / <sub>16</sub>
C	14 <sup>3</sup> / <sub>8</sub>	14 <sup>3</sup> / <sub>8</sub>	16 <sup>7</sup> / <sub>8</sub>
D	20 <sup>3</sup> / <sub>16</sub>	20 <sup>3</sup> / <sub>16</sub>	22 <sup>7</sup> / <sub>8</sub>
E	11	11	11 / 13 <sup>1</sup> / <sub>8</sub>
F	5 <sup>1</sup> / <sub>2</sub>	5 <sup>1</sup> / <sub>2</sub>	5 <sup>1</sup> / <sub>2</sub> / 6 <sup>3</sup> / <sub>16</sub>
G	20	20	22 <sup>3</sup> / <sub>8</sub>

### 3000/5000/10,000 Meters

Dimensions (Inches)	3000	Model 5000	10,000
A	36 <sup>1</sup> / <sub>4</sub>	43 <sup>1</sup> / <sub>16</sub>	49 <sup>9</sup> / <sub>16</sub>
A <sub>1</sub>	27 <sup>1</sup> / <sub>2</sub>	34 <sup>1</sup> / <sub>8</sub>	40 <sup>1</sup> / <sub>4</sub>
A <sub>2</sub>	28 <sup>1</sup> / <sub>4</sub>	34 <sup>15</sup> / <sub>16</sub>	41 <sup>1</sup> / <sub>16</sub>
A <sub>3</sub>	26 <sup>15</sup> / <sub>16</sub>	33 <sup>9</sup> / <sub>16</sub>	39 <sup>3</sup> / <sub>4</sub>
B	21 <sup>1</sup> / <sub>2</sub>	27 <sup>3</sup> / <sub>16</sub>	31 <sup>3</sup> / <sub>4</sub>
C	16	19 <sup>11</sup> / <sub>16</sub>	26 <sup>3</sup> / <sub>8</sub>
D	21 <sup>1</sup> / <sub>2</sub>	26	31 <sup>3</sup> / <sub>4</sub>
E	13	17 <sup>1</sup> / <sub>4</sub>	21 <sup>1</sup> / <sub>4</sub>
F	24 <sup>1</sup> / <sub>4</sub>	30 <sup>15</sup> / <sub>16</sub>	37 <sup>1</sup> / <sub>16</sub>
G	9 <sup>1</sup> / <sub>2</sub>	10	16 <sup>1</sup> / <sub>4</sub>
H	7 <sup>1</sup> / <sub>2</sub>	8	13 <sup>1</sup> / <sub>4</sub>
I	27 <sup>1</sup> / <sub>2</sub>	32	37 <sup>3</sup> / <sub>4</sub>

### Specifications

Meter	Maximum Working Pressure (psig)	Capacity @ 1/2" w.c. diff. of 0.6 Sp. Gr. Gas CFH	Capacity @ 2" w.c. diff. of 0.6 Sp. Gr. Gas CFH	ft <sup>3</sup> /REV of Output Shaft Standard*	m <sup>3</sup> /REV of Output Shaft	REV/ cu. ft.	Actual Weight Lbs.	Shipping Weight Lbs.	Standard Connections	Other Available Connections
750	20	750	1600	10	0.1	2.6	51	55	45 Lt.	30, 60 Lt., No. 3 Spg., 1 1/2" FTP, 2" NPT
1600	100	800	1600	10	0.1	2.6	70	75	45 Lt.	30, 60 Lt., No. 3 Spg., 1 1/2" FTP
1000	25	1000	2200	10	0.1	1.6	55	60	45 Lt.	60, 100 Lt., No. 3 Spg., 1 1/2" or 2" FTP No. 5 Spg. on 1000 only
3000 w/o flanges	100	1450	3000	10	0.1	1.3	107	135	3"-8 NPT	2"-11 1/2 NPT
w/ flanges	100	1450	3000	10	0.1	1.3	120	154	3" Flange	2" Flange
5000 w/o flanges	100	2500	5000	10	1 or 0.1	0.5	198	238	4"-8 NPT	3"-8 NPT
w/ flanges	100	2500	5000	10	1 or 0.1	0.5	233	270	4" Flange	3" Flange
10,000 w/o flanges	100	5000	10000	100	1	0.32	323	389	4"-8 NPT	3"-8 NPT
w/ flanges	100	5000	10000	100	1	0.32	360	420	4" Flange	3" Flange

\* Other outputs available upon request on some models.

A — Type I Mechanical Instruments and all  
Electrocorrector Models\*A<sub>1</sub> — Vertical Direct Reading (VDR) Index in  
Aluminum BoxA<sub>2</sub> — Vertical Circular Reading (VCR) and Vertical  
Direct Reading (VDR) Indexes in Lexan  
CoversA<sub>3</sub> — Horizontal Circular Reading (HCR) Index\* Contact your Sensus representative for dimen-  
sions of NexCorr.



## Sensus Diaphragm Meter Installation Instructions

The badge end of the meter designates the inlet and is so indicated (on the badge). The maximum working pressure and rated capacity of the meter at 1/2" and 2" water column differential are also marked on the badge. This rated working pressure is not to be exceeded.

It is recommended that large capacity meters be installed with a bypass line to facilitate future repairs without interruption of service.

The inlet pipe of the meter should be blown clean before installing the meter. Pipe turnings, weld spatters, scale, dirt and other foreign materials can cause serious damage to valves, valve seats, and bearings resulting in excessive wear on these parts and loss of meter accuracy. Where condensation is a problem, the line on the upstream side of the meter should have drip traps to prevent the condensation from collecting in the meter. Standard drains are available on all sizes with the exception of the 1000 meter. The threads of the Inlet and Outlet piping should be inspected for dirt and damage. Dirt, damaged threads, or weld spatters and other materials in the threads can be a cause of leakage or damage to meter connection threads.

Caution is necessary when placing the meter into service after installation as any excessive build-up of differential across the diaphragms, valves and channels may cause rupturing of the diaphragm, distortion of the diaphragm pans, bowing or cracking body partitions, and other possible serious damage.

The following procedure should be followed to place a meter into service on an installation with a bypass line:

1. Slowly crack the meter outlet valve.
2. Slowly crack the meter inlet valve until the proving hand has started to move.
3. Very slowly open the outlet valve until completely opened.
4. Very slowly open the inlet valve until completely opened.
5. Slowly close the bypass line valve.

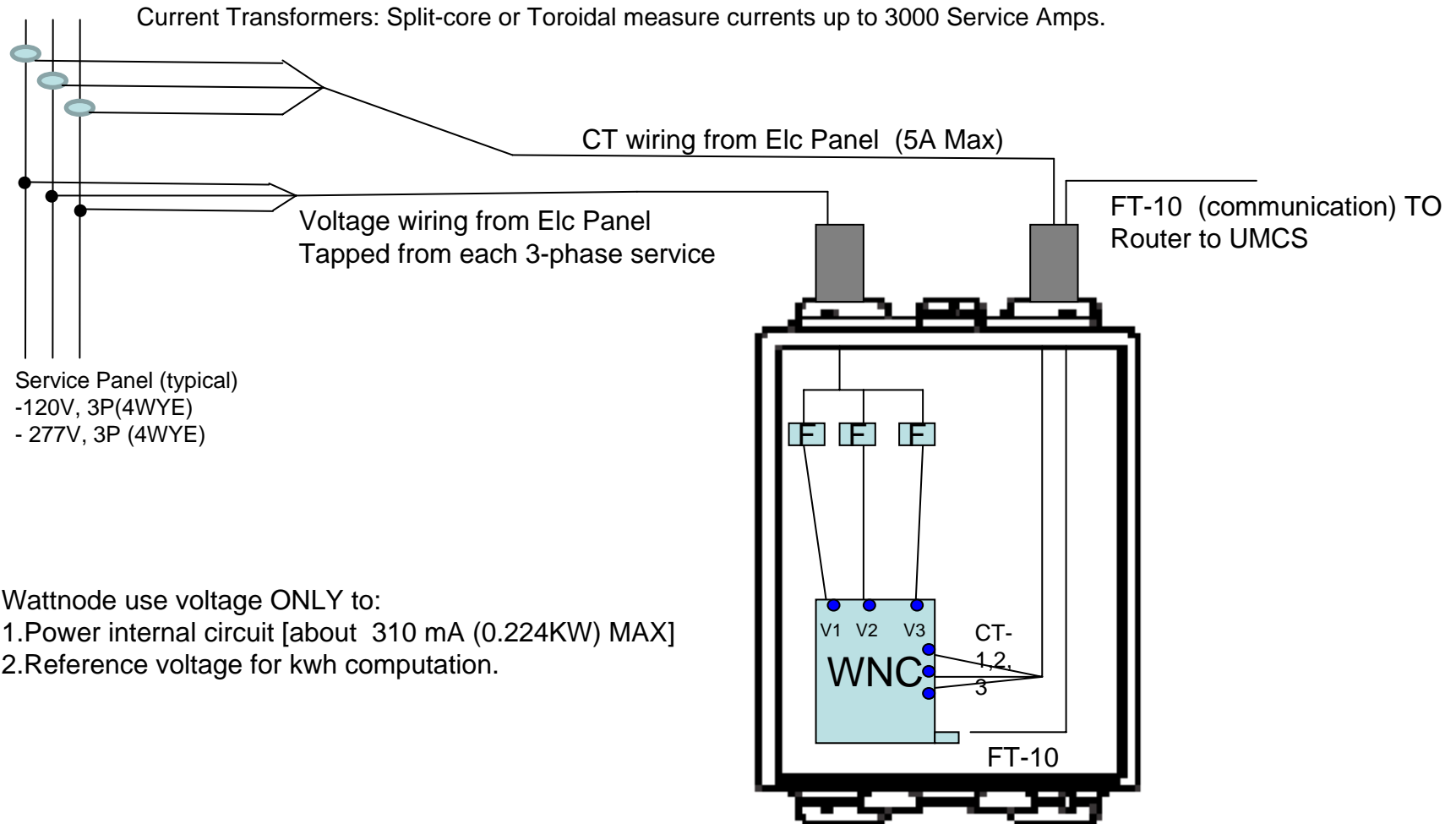
To put the meter into service on an installation without a bypass line, the valve on the outlet of the meter, if there is one, should be opened first. The meter inlet valve should then be very slowly cracked to insure no excessive build-up of differential. After the proving hand of the meter has started to move, continue to very slowly open the valve until completely opened.

Excessively high differentials across the chambers and channels of the meter can also be caused by a sudden reduction in pressure due to blowing drips or removing a meter from service. There is no substitute for extreme caution and care in placing any meter into service or removing any meter from service.

## How to Order

When ordering Sensus Diaphragm Meters, the following information must be defined. This will insure the greatest possible speed and accuracy in filling orders.

- Meter Model
- Standard (NTC) or temperature compensated (TC)
- Maximum flow rate (cubic feet or M<sup>3</sup> per hour)
- Specific gravity of gas
- Maximum rated working pressure, psig
- Type readout desired (specify cubic feet or metric):
  - HCR—Horizontal Circular Reading Index
  - VCR—Vertical Circular Reading Index
  - VDR—Vertical Direct Reading Index
- Volume Corrector (specify model)
- Size of piping connections
- Type of piping connections (flanged or screwed)
- Diaphragm drains, if desired. (Not available on Model 1000.)



Wattnode use voltage ONLY to:

- 1.Power internal circuit [about 310 mA (0.224KW) MAX]
- 2.Reference voltage for kwh computation.

Approved NEMA Enclosure



## Continental Control Systems

# WATTNODE® PLUS

## AC Power Measurement for LonWorks®

**THE WATTNODE PLUS** for LonWorks is a networked, multi-function digital power meter and monitor. The WATTNODE PLUS offers true RMS power metering, PLUS demand, PLUS individual phase voltage and current, PLUS individual and average power factor, PLUS reactive power and energy metering, PLUS frequency. Typical applications include energy monitoring, sub-metering, demand management, power factor control and phase-load monitoring.

**NETWORKING** the WATTNODE PLUS for LonWorks is easy. A simple twisted-pair connection links all devices together into a dependable LonWorks network. In addition, a LonWorks gateway provides network access via the Internet. Measurements are transmitted over the network as Standard Network Variable Types (SNVTs).

**EASE OF USE** and economy of installation were key design criteria. The WATTNODE PLUS' compact size permits installation inside of most electrical service panels and junction boxes. Detachable screw terminals make wiring a snap. The WATTNODE PLUS is line-powered and requires no separate power source.

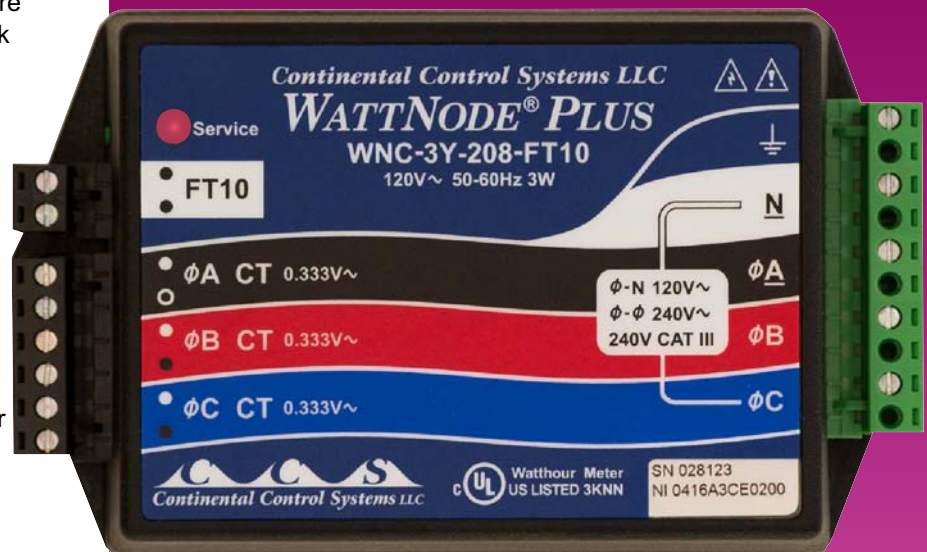
**ACCURACY** of the WATTNODE PLUS is 0.5% of reading. Even with leading or lagging power factor and chopped or distorted wave forms, the WATTNODE PLUS measures true RMS power. This makes it ideal for monitoring motors and pumps controlled by variable speed drives or loads with switching power supplies.

**THE COMPLETE LINE** of WATTNODE PLUS models measures 1, 2, or 3 phases in 2, 3, or 4 wire configurations with nominal voltages from 120 to 600 VAC at 50/60 Hz. Select the current range of operation from our line of safe, low-voltage output, current transformers. Split-core or solid-core CTs measure currents up to 3000 Amps.



**Continental Control Systems LLC**  
3131 Indian Road, Suite A  
Boulder, CO 80301 USA  
(303) 444-7422 Fax (303) 444-2903  
sales@ccontrolsys.com  
www.wattnode.com

**Toll-Free**  
**(888) 928-8663**



- Measures KW, KWH, Demand, KVAR, KVARH, PF, Amps, Volts, Frequency  
Multiple measurements in one unit
- LonWorks Network Ready  
Simple twisted-pair network installation, Internet accessible
- Compact Size  
Fits inside of standard power panels and junction boxes

- LonWorks Interoperable  
Easy to integrate into network
- Measures 1<sup>Ø</sup>, 2<sup>Ø</sup>, 3<sup>Ø</sup> Circuits  
Flexible, field configurable
- Line Powered  
No external power supply required

Friday, June 18, 2010

WattNode is a registered trademark of Continental Control Systems LLC  
LonMark, the LonMark logo and LonWorks are registered trademarks of Echelon Corporation

# Specifications

## Quantities Measured

Energy: Real and Reactive  
 Power: Real and Reactive, per phase and average  
 Voltage: Per phase volts  
 Current: Per phase amps  
 Frequency: Phase A  
 Power Factor: Per phase and average  
 Demand: Block or sliding window  
 Peak Demand: Value and time

## Quantities Retained during Loss of Power

Accumulated energy  
 Peak demand  
 Time of peak demand  
 Instrument configuration data

## Measurement Configuration

Three phase: 3-wire or 4-wire  
 Single phase: 2-wire or 3-wire

## LonWorks Interoperability

40 network variables using Standard  
 Network Variable Types (SNVTs):  
 Energy: SNVT\_elec\_whr\_f  
 Power: SNVT\_power\_f  
 Volts: SNVT\_volts\_f  
 Current: SNVT\_amp\_f  
 Power Factor: SNVT\_pwr\_fact\_f  
 Frequency: SNVT\_freq\_f  
 Time: SNVT\_time\_stamp

## User Controlled Inputs

Set CT size in amps  
 Set demand window type and period  
 Reset peak demand to zero  
 Set time of day

## Accuracy

Power & Energy 0.45% of reading, plus 0.05% of full-scale

## Electrical

Operating Voltage Range: 80% - 120% of nominal  
 Power Line Frequency Range: 45 to 65 Hz

## Environmental

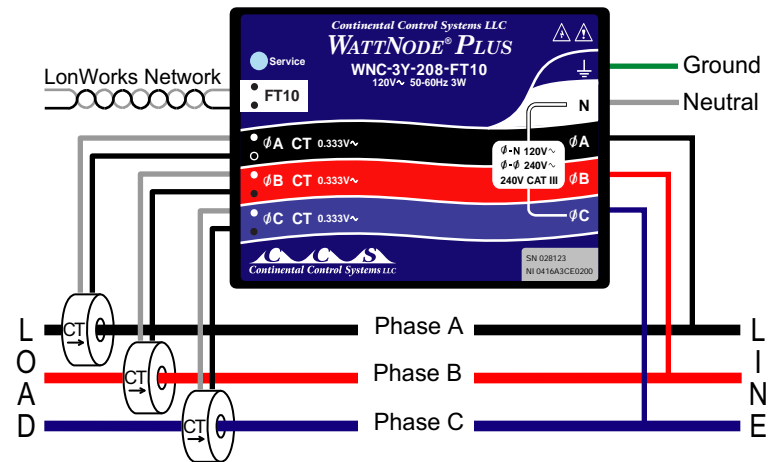
Temperature: -30<sup>0</sup> C to 60<sup>0</sup> C  
 Humidity: 5 to 90% RH (noncondensing)

## Mechanical

Enclosure: High impact, UL rated, ABS plastic  
 Size: 3.3" x 5.6" x 1.5" (includes mounting tabs)  
 Connectors: Detachable screw terminals  
 (22-12 AWG)

# WATTNODE<sup>®</sup> PLUS

## AC Power Measurement for LonWorks<sup>®</sup>



## MODELS

Model	VAC	VAC	Phases	Wires
	Line To Neutral	Line To Line		
WNC-3Y-208-FT10	120	208-240	3*	4
WNC-3Y-400-FT10	230	400	3*	4
WNC-3Y-480-FT10	277	480	3*	4
WNC-3Y-600-FT10	347	600	3*	4
WNC-3D-240-FT10	N/A	208-240	3	3
WNC-3D-400-FT10	N/A	400	3	3
WNC-3D-480-FT10	N/A	480	3	3

\*Can be used to measure 1, 2 or 3 phase circuits.

## OPENING CURRENT TRANSFORMERS (SPLIT CORE)

Model	Inside Diameter	Rated Amps
CTS-0750	0.75"	5, 15, 30, 50, 70, 100, 150
CTS-1250	1.25"	70, 100, 150, 200, 250, 300, 400, 600
CTS-2000	2.00"	600, 800, 1000, 1200, 1500
CTB	Bus Bar	600, 800, 1200, 2000, 3000 (custom)

## TOROIDAL CURRENT TRANSFORMERS (SOLID CORE)

Model	Inside Diameter	Rated Amps
CTT-0300	0.30"	5, 15, 20, 30
CTT-0500	0.50"	15, 20, 30, 50, 60
CTT-0750	0.75"	30, 50, 70, 100
CTT-1000	1.00"	50, 70, 100, 150, 200
CTT-1250	1.25"	70, 100, 150, 200, 250, 300, 400

Current Transformer Output Voltage: 0 - 0.333 VAC @ rated current



3131 Indian Road, Suite A  
 Boulder, CO 80301  
 (303) 444-7422 Fax (303) 444-2903  
 sales@ccontrolsys.com  
 www.wattnode.com

Friday, June 18, 2010

**MADE IN THE USA**

**(888) 928-8663**

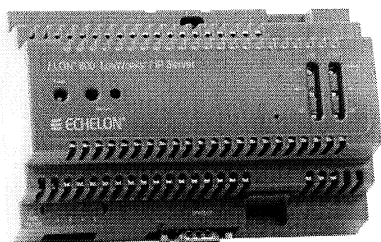
**WattNode® Plus Electric Power Meter  
With LonWorks® Free-Topology Transceiver**

**Engineering Specifications**

1. The power meter shall make true RMS power measurements on multi-phase electrical circuits.
2. The power meter shall transmit the following readings:
  - a. Real power (watts) total for all phases and for each phase
  - b. Real energy (watt-hours) consumed total for all phases and for each phase
  - c. Demand (watts) over user specified interval (block or sliding window)
  - d. Peak demand (watts) and time of peak demand since reset
  - e. Current (amps) for each phase
  - f. Phase-to-neutral or phase-to-ground (delta models) voltage
  - g. Power factor for each phase and average
  - h. Reactive power (watts) total for all phases and for each phase
  - i. AC frequency
3. The power meter shall communicate using the LonTalk® protocol (ANSI/CEA-709.1-B-2002) and LonMark specified TP/FT-10 free-topology and bus twisted-pair transceiver (ANSI/CEA-709.3).
4. The power meter shall have a unique Neuron ID number which is externally visible.
5. The power meter shall be UL and cUL listed and meet safety standards UL1244 or UL 61010-1.
6. The power meter shall derive operating power from its metering connections, and shall not require a separate power connection.
7. Power meter models must be available to directly accept voltage input at one of the following voltages: 120, 208-240, 277, 347 or 480 VAC (50 or 60Hz).
8. The power meter shall accept 0 to 0.333VAC input from up to three current transducers.
9. The power meter shall be fitted with detachable terminal blocks for all wiring connections.
10. The measured energy consumption shall be retained in non-volatile memory.
11. The demand measurement shall be programmable for intervals of 5 to 720 minutes with up to 8 subintervals.
12. The maximum demand and time of maximum demand shall be stored in non-volatile memory and can be reset.
13. The power meter shall log at least 35 days of total real energy readings at 15 minute intervals to non-volatile memory.
14. The power meter shall be calibrated with NIST traceable standards to an accuracy of 0.5% or better.
15. The power meter shall operate from -30C to +60C.
16. The power meter shall have dimensions not exceeding 5.7" x 3.4" x 1.5".
17. The power meter shall be Continental Control Systems' WattNode Plus model.



## ***i*.LON® 600 LONWORKS®/IP Server Models 72601R, 72602R, 72603R, and 72604R**



### **Description**

The *i*.LON 600 LONWORKS/IP Server is an EIA-852 compliant, LonTalk®-to-IP router that provides reliable, secure Internet access to everyday devices like pumps, motors, valves, sensors, actuators, and lights. Offering unparalleled packet throughput, rugged construction, and simple commissioning, the *i*.LON 600 is ideal for demanding process control, building automation, utility, transportation, and telecommunications applications. U.L. and c.U.L. Listed, TÜV certified, and FCC, RoHS, and CE Mark compliant, the *i*.LON 600 server meets worldwide regulatory agency requirements.

The *i*.LON 600 LONWORKS/IP Server transforms the Internet—or any 10 or 100 BaseT IP-based LAN or WAN—into a pathway for carrying LONWORKS control information locally or remotely. Secure access is ensured by the use of MD5 authentication, while a 32-bit RISC processor and Echelon's LONWORKS/IP architecture provide best-of-class performance for high-speed control, display, and monitoring applications.

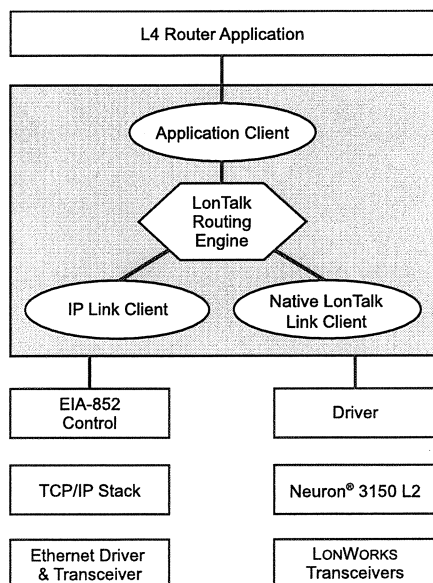
- ▼ Transforms the Internet (or any IP-based LAN or WAN) into a pathway for carrying LONWORKS control information locally, nationally, or around the world
- ▼ Provides highest performance Layer 3 routing of LONWORKS control packets
- ▼ Supports LONWORKS/IP channels up to 256 devices
- ▼ Supports multiple units behind NAT firewalls
- ▼ EIA-852 & ANSI/EIA 709.1 compliant
- ▼ Security features include MD5 authentication for secure access
- ▼ 8T DIN packaging
- ▼ 24V AC or DC or 90V-240V AC or DC power input options
- ▼ CE Mark, U.L. Listed, c.U.L. Listed, TÜV Certified, RoHS

Up to 256 *i*.LON 600 servers may be used on the same channel, and multiple servers can operate behind a Network Address Translation (NAT) firewall. The *i*.LON 600 LONWORKS/IP Server is backward compatible with the *i*.LON 1000 Internet Server, and both *i*.LON 600 LONWORKS/IP Servers and *i*.LON 1000 Internet Servers can co-exist in the same network. This feature ensures that existing applications can be fully supported while providing an expansion pathway to accommodate adds, moves, and changes.

Both TP/FT-10 and TP/XF-1250 LONWORKS channel options are available. The free topology TP/FT-10 channel provides the greatest wiring flexibility. The TP/XF-1250 channel is most commonly used for high performance industrial controls and high-speed backbone channels, and provides high throughput for applications with a large number of devices.

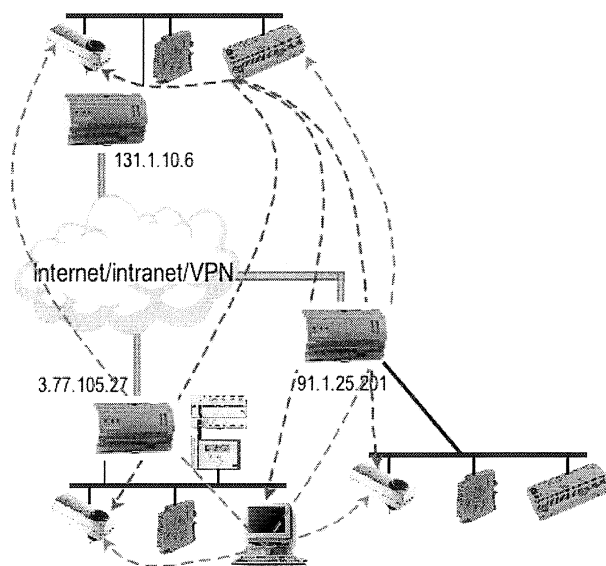
The *i*.LON 600 server includes an LNS Remote Network Interface (RNI) that can be used to create a local or remote network connection for LNS or OpenLDV applications including the LonMaker Integration Tool. A single LNS application can simultaneously manage, monitor, and control many remote LONWORKS networks by installing an *i*.LON 600 server in each remote network.

Model 65202R is compliant with the European Directive 2002/95/EC on the restriction of the use of certain hazardous substances (RoHS) in electrical and electronic equipment.



## Peer-to-Peer and Master-Slave Support

The *i*.LON 600 LONWORKS/IP Server supports both peer-to-peer and master-slave networks, allowing remotely located devices to communicate over IP networks as if they were co-located. Devices on different floors of a building, scattered across different manufacturing pods, or located in retail branches around the world can be seamlessly and transparently linked together – and connected to far-flung corporate data and ERP networks.



## Network Installation

The *i*.LON 600 LONWORKS/IP Server is installed using standard LONWORKS installation tools such as the LonMaker Integration Tool. For pre-configured LONWORKS installations, the *i*.LON 600 LONWORKS/IP Server can be self-installed by setting parameters on a set-up web page. Whether part of an engineered or pre-configured system, the *i*.LON 600 LONWORKS/IP Server is the ideal means to connect everyday devices through an IP-based network.

## Specifications

### Minimum PC Requirements

for Configuration Server Software    Pentium II @ 600 MHz, 128KB RAM, 10MB free disk space

Processor    AMD Au1000 32-bit RISC

Channel Type    TP/FT-10 (Models 72601 & 72603)

TP/XF-1250 (Models 72602 & 72604)

LONWORKS Twisted Pair Connector    Screw Terminals

Ethernet Port    10/100 BaseT, auto-selecting, auto polarity

Ethernet Connector    RJ-45

Console Interface    EIA-232, 9600 baud (8 data bits, no parity, 1 stop bit)

Console Connector    DB-9

## IT Manager Friendly

The *i*.LON 600 LONWORKS/IP Server behaves like a typical IP host from the perspective of the IT network to which it is connected. Like other IP hosts, the *i*.LON 600 LONWORKS/IP Server supports standard internetworking protocols including TCP/IP, DHCP, ICMP, SNTP, MD5, HTTP, and FTP. Adjustable packet aggregation and bandwidth utilization parameters ensure that the *i*.LON 600 LONWORKS/IP Server is a “good citizen” on the IP network. These parameters, as well as addressing and security functions can all be adjusted via the IP network.

## Power Supply and Enclosure

Two power supply options enable the *i*.LON 600 LONWORKS/IP Server to operate from 90V -240V AC or DC, or as a safety-agency approved low-voltage 24V AC or DC device. The fully-isolated high-voltage power supply allows Line-to-Line or Line-to-Neutral connections across the entire voltage range.

The low-voltage option provides a number of unique advantages:

- ▼ Powering the server from a 24VDC rechargeable power supply permits non-stop operation in the event of a power failure.
- ▼ Supporting both 24V AC or DC input power permits the use of a wide range of power supplies including both plug-in and hard-wired options.
- ▼ Eliminating high voltage wiring can reduce wiring costs and eliminate the need for an insulated, protective enclosure.

The *i*.LON 600 LONWORKS/IP Server is supplied in a compact 8T DIN package manufactured from flame-resistant plastic, and is suitable for mounting to a 35mm DIN rail. Screw terminals simplify power and LonTalk channel wiring connections, while an array of front panel status LEDs provide valuable information about the status of the server.

Operating Input Voltage	+24V AC or DC, $\pm 33\%$ , <15 Watts (Models 72603 & 72604) 90V - 240V AC or DC, 50-60 Hz (Models 72601 & 72602)
Power Connector	Screw Terminals
Controls (Switches)	Reset & Service switches
Indicators (LEDs)	Power On, Ethernet Link, Activity, 10/100 Mbps, LONWORKS Tx/Rx, Connect
Neuron Chip Service Pin Function	Service pin message controlled by console application or hardware service switch
Temperature	
Operating	0° to +50° C
Non-operating	-40° to +85° C
Humidity (non-condensing)	
Operating	10% to 90% RH @ 50°C
Non-operating	90% RH max @ 50°C
Enclosure	8TE DIN
Dimensions	8.9cm x 13.8cm, x 6.6cm HxWxD (3.51" x 5.47" x 2.60" HxWxD)
EMC	FCC Part 15 Class B and EN55022 Class B, EN55024, CISPER 22 Class B, VCCI Class B
Agency Listing	UL 60950, cUL, C22.2 No. 60950-00, TÜV EN60950, CE, C-Tick

## Documentation

The *i.LON 600 LONWORKS/IP Server User's Guide* is provided in PDF format on the product CD or may be downloaded from [www.echelon.com/ilon](http://www.echelon.com/ilon). A printed version of the *i.LON 600 LONWORKS/IP Server Quick Start Guide* ships with each unit.

Document	Echelon Part Number
<i>i.LON 600 LONWORKS/IP Server User's Guide</i>	078-0272-01
<i>i.LON 600 LONWORKS/IP Server Quick Start Guide</i>	005-0153-01

## Ordering Information

Product	Echelon Model Number
<i>i.LON 600 LONWORKS/IP Server</i> , TP/FT-10 channel, 90V - 240V AC or DC	72601R
<i>i.LON 600 LONWORKS/IP Server</i> , TP/XF-1250 channel, 90V - 240V AC or DC	72602R
<i>i.LON 600 LONWORKS/IP Server</i> , TP/FT-10 channel, 24V AC or DC	72603R
<i>i.LON 600 LONWORKS/IP Server</i> , TP/XF-1250 channel, 24V AC or DC	72604R

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### Disclaimer

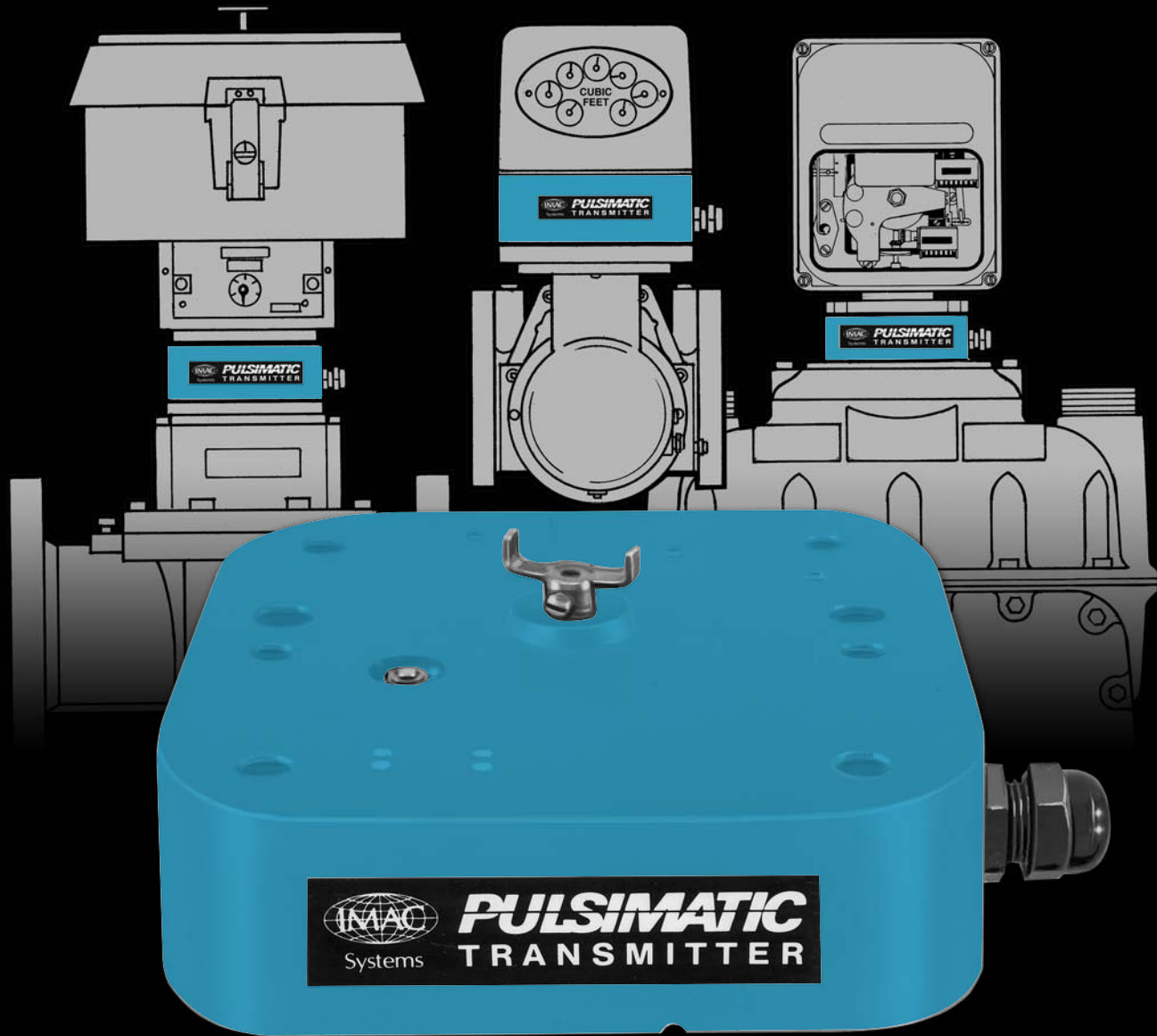
Neuron Chips, Free Topology Twisted Pair Transceiver Modules, and other OEM Products were not designed for use in equipment or systems which involve danger to human health or safety or a risk of property damage and Echelon assumes no responsibility or liability for use of the Neuron Chips or Free Topology Twisted Pair Transceiver Modules in such applications. ECHELON MAKES AND YOU RECEIVE NO WARRANTIES OR CONDITIONS, EXPRESS, IMPLIED, STATUTORY OR IN ANY COMMUNICATION WITH YOU, AND ECHELON SPECIFICALLY DISCLAIMS ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. 003-0379-01C



# PULSIMATIC TRANSMITTER



**THE IMAC PULSIMATIC TRANSMITTER** is the economical way to transmit uncorrected volume output data from gas meters to remote totalizing and recording equipment. Available in ten different pulse outputs to fill most requirements.



**IMAC Systems, Inc.**

International Measurement and Control Systems

**Manufacturers/Distributors of  
Precision Gas Measurement Equipment**

**IMAC SYSTEMS, INC.**

P.O. Box 1605, 90 Main Street, Tullytown, PA 19007 1-800-955-4GAS Tel: (215) 946-2200 Fax: (215) 943-2984  
**www.imacsystems.com** Email: sales@imacsystems.com

Distributed by:

Friday, June 18, 2010

## IMAC PULSIMATIC TRANSMITTER



### Features

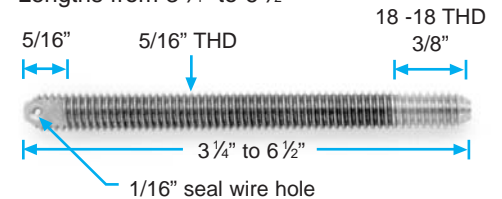
- VIRTUALLY indestructible low profile does not interfere with existing piping arrangement.
- ONE-PIECE cast aluminum housing, precision machined. Provides the **optimum protection** for the pulsing mechanism along with precise mechanical action.
- SINGLE or DOUBLE independent outputs available on all models.
- FITS all types of industrial size meters with a vertical mechanical index: Diaphragm — Rotary — Turbine. (See DMP literature for front mounted indexes)
- OPERATES at extremely low torque.
- MOUNTS between meter and index or instrument.
- IDEAL for Data Acquisition Systems.
- Also available: Bottom seal plate (301-0070) to eliminate overhang (recommended for certain applications).
- Special adapter kit (DMK217) for Actaris Meters 675A, 800A, 1000A.
- CSA Approved LR11378  
Underwriters Recognition #E186234.

- AVAILABLE in the following pulses per revolution of the drive shaft:  
1/2 / 1 / 2 / 5 / 10 / 20 / 50 / 100 / 500 / 1000

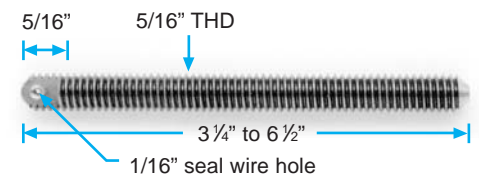
### Mounting Hardware

Special studs with 18 - 18 threads available and necessary for American Meter.

Lengths from 3 1/4" to 6 1/2"



Standard kits include 3 1/4" brass mounting studs with sealing wire holes and SST nuts and washer.

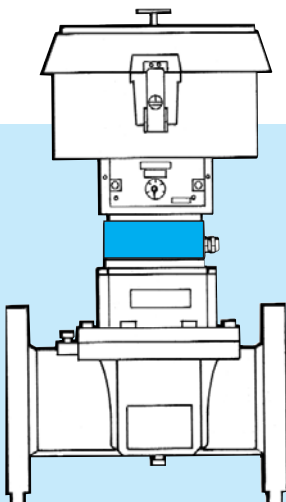
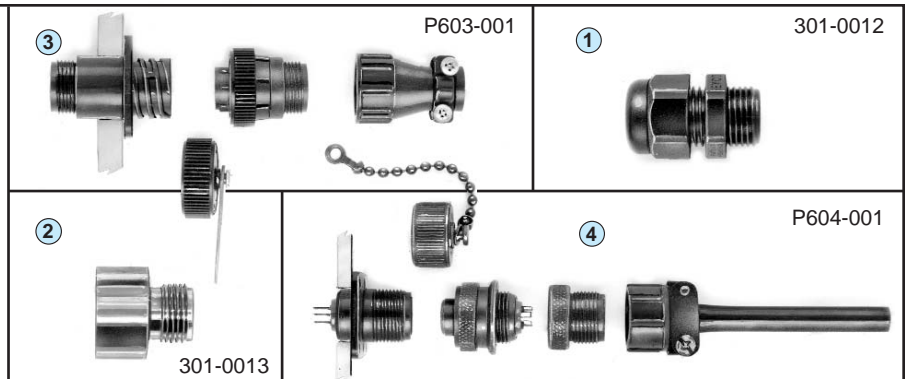


### Electrical Output Connections:

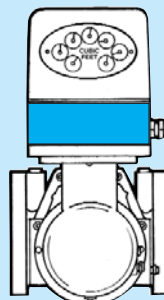
- ① STANDARD: Compression Fitting

### Optional:

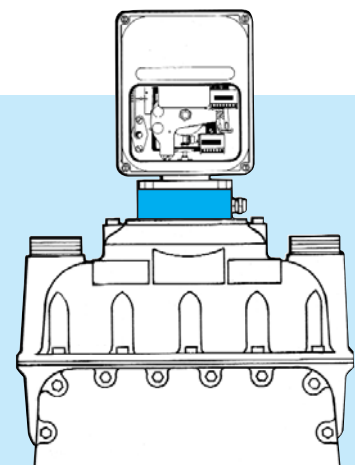
- ② 1/2" N.P.T. conduit adapter - aluminum
- ③ Plastic weatherproof receptacle with external quick disconnect
- ④ Metallic weatherproof receptacle with external quick disconnect



MOUNTED BETWEEN TURBINE  
METER AND INSTRUMENT



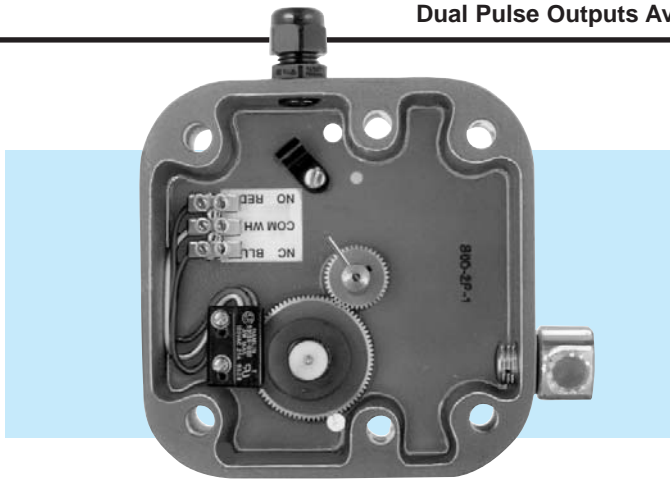
MOUNTED BETWEEN ROTARY  
METER AND INDEX



MOUNTED BETWEEN DIAPHRAGM  
METER AND INSTRUMENT



## Dual Pulse Outputs Available on all Models

**Standard Version - 1/2, 2, 5, 10, 20, 50 PULSE/REV**

Pulse created through Dry Contact Form C Reed Switch, triggered by multi-pole magnet.

**Switch Electrical Characteristics**

**Maximum Switching Voltage:** 175 dc

**Minimum Breakdown Voltage:** 200 dc

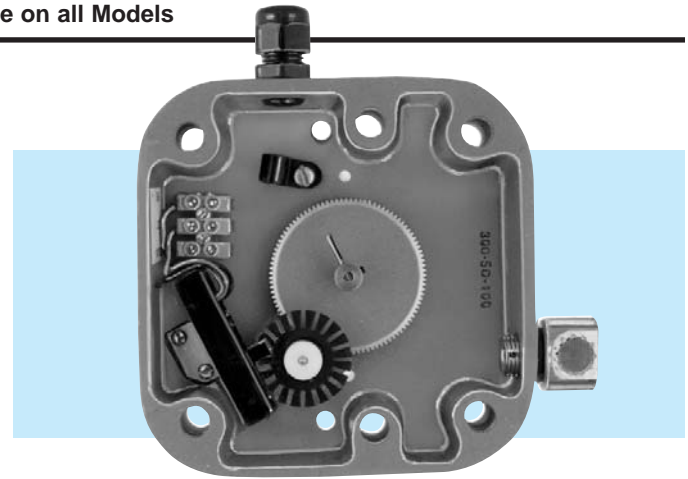
**Maximum Switching Current:** 250 ma

**Initial Contact Resistance:** 200 ohms

**Operating Time:** 0.7 milliseconds

**Operating Temperature:** -40° to 105° C

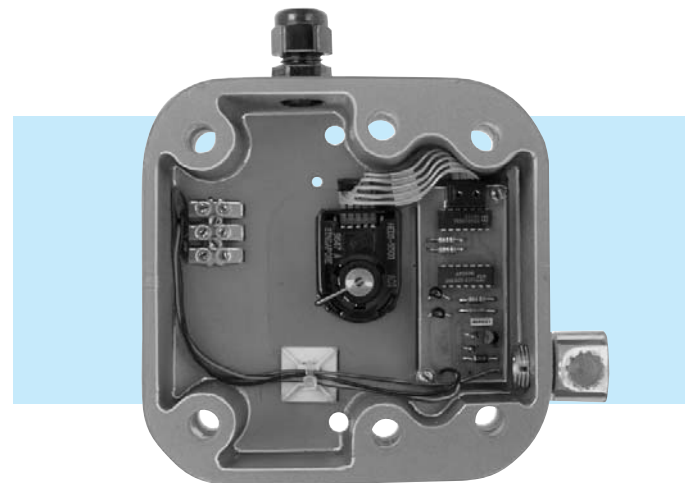
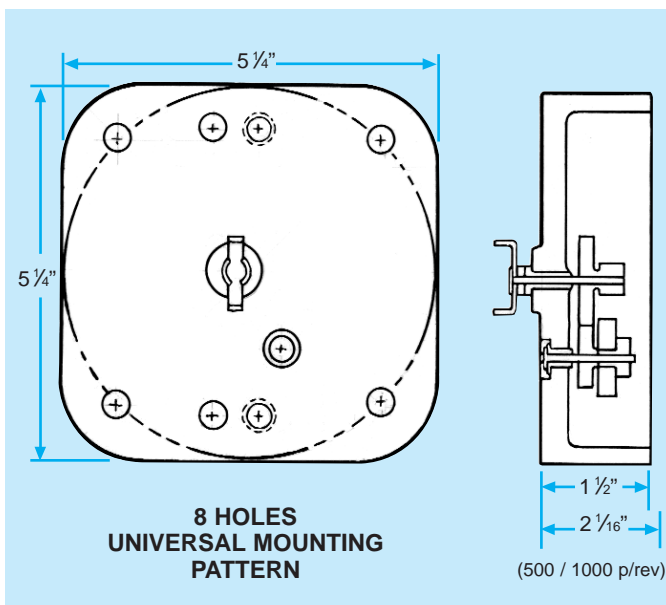
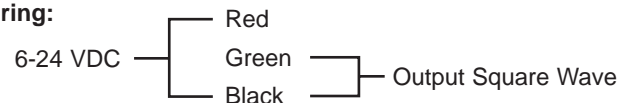
**Anticipated Minimum Life:** 50,000,000 cycles at 5 VDC, 10 ma



**100 PULSE/REV** version of the Pulsimatic Transmitter provides higher frequency outputs utilizing an Optical Encoder. Useful when higher resolution or higher frequencies are needed.

**Wiring and power requirements are as follows:**

Power Supply: 6-24 VDC Output Square Wave with same amplitude as power supply.

**Wiring:****500/1000 PULSE/REVOLUTION PULSIMATIC**

This special version of the Pulsimatic Transmitter is designed to produce a quality, high resolution, high frequency pulse output. Its mechanical design is essentially the same as the standard Pulsimatic but the only difference being that the housing is 1/2" taller. Consequently, the same installation guidelines used with any Pulsimatic apply to this model.

The electronics feature a high output encoder whose signal is processed and amplified through a customized circuit board. The specifics of this design allow for a power supply of 6-24 VDC with an output square wave of equal amplitude to the selected input voltage or a selectable 5 V regulated output. Wiring and operation is the same as 100 pulse/rev Pulsimatic.



International Measurement and Control Systems

Manufacturers / Distributors of  
Precision Gas Measurement Equipment

## IMAC Electronic Remote Totalizer

The Remote Totalizer line is an inexpensive way to remote read, totalize, normalize, standardize and retransmit pulses or obtain an instantaneous flow rate. The products featured are all made in America by IMAC Systems, Inc.

### R1 Remote Totalizer - Pulse Counter

- Simple Pulse Counter
- Counts either low frequency or high frequency
- Battery powered with 7 - 10 year life
- Toggle reset inside enclosure
- 8-digit LCD display
- NEMA 4 Enclosure\*: 5" width x 5" height x 3 3/4" depth

### R2 Remote Totalizer - Remote Volume Totalizer

- Counts switch closures
- Battery powered with 7 - 10 year life
- Divide capability by 2, 10 and 100
- Optional push button counter stop
- 6-digit LCD display
- Toggle reset inside enclosure
- NEMA 4 Enclosure\*: 5" width x 5" height x 3 3/4" depth

### R3 Remote Totalizer - Remote Fixed Factor Totalizer

- Counts either low frequency or high frequency
- Applies conversion factors to input pulses - to normalize, standardize, or convert measurement units
- Useful for fixed factor pressure conversion to show corrected volume
- Features a Form C relay for a factored pulse output
- 120 / 230 Volt AC power required
- 6-digit LCD display
- Toggle reset inside enclosure
- NEMA 4 Enclosure\*: 7 1/4" width x 9 1/4" height x 5" depth

### R4 Remote Totalizer - Remote Totalizer with Flow Rate Indication and Analog Output

- Accepts either low frequency or high frequency
- Displays volume and flow rate
- Can program measurement units in USCS (English Units) or SI (Metric Units) and apply fixed factors
- Generates a 4-20mA output proportional to flow rate
- 120 / 230 Volts AC power required
- 8-digit LCD display
- NEMA 4 Enclosure\*: 7 1/4" width x 9 1/4" height x 5" depth



\*NEMA 4 enclosures are intended for indoor and outdoor use. They provide protection against windblown dust, rain, splashing and hose directed water. The fiberglass reinforced polyester construction allows the product line to be nonconductive, lightweight and impact resistant.

\*\*The range for remote totalizers is 1000 ft. using 18 - 22 gauge shielded cable (available at IMAC)

\*\*\*The operating temperature range for the remote totalizers is -20° F to +145° F; the storage temperature is -40° F to +160° F

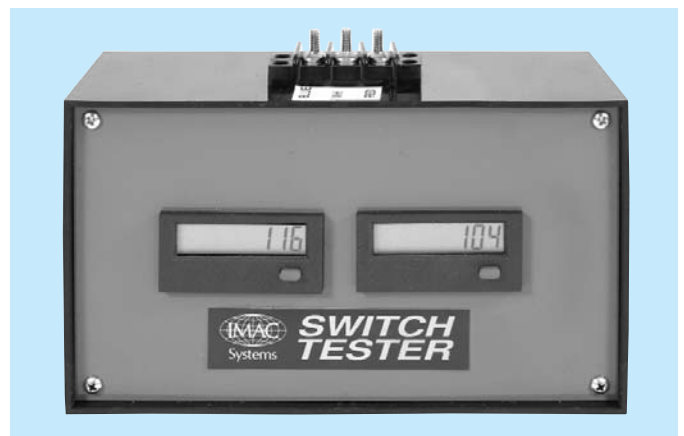
## Ideal Way to Test Switch Performance Accepts Form A or Form C Inputs

### Features / Specifications

- Can be rigged for quick test connections for any manufacturer's pulser
- 6" x 3" x 2 1/2" plastic case
- Contains 2 - 1000 Hz capacity resettable counters
- Extremely portable, easy-to-use, battery powered

### How to Use

- Wire switch to appropriate terminals
- Check indicated counts against expected or measured counts
- With Form C switch, the Switch Tester will indicate switch "Flutter" by disproportionate counts on each display
- Can compare two Form A outputs simultaneously



International Measurement and Control Systems

**IMAC SYSTEMS, INC.**

P.O. Box 1605

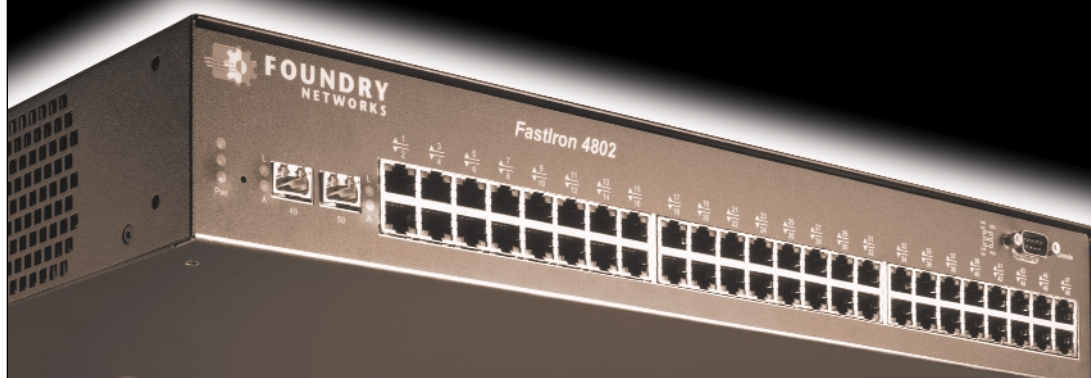
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Friday, June 18, 2010

# FASTIRON 4802



## S P E C I F I C A T I O N S

FastIron 4802 is the first in a new class of products that delivers industry leading port density, performance and features in a highly-compact 1.5U form factor, making it an ideal choice as a Layer 2/3 10/100 aggregation and access switch in Enterprise and Service Provider networks.

Based on Foundry's 3rd generation JetCore ASIC chipsets, the FastIron 4802 provides 48 10/100 ports and two optional Gigabit Ethernet uplink ports, as well as a comprehensive Layer 2/3 feature set including embedded support for Bandwidth Provisioning, rich QoS and IP Billing and Accounting. Hot-swappable redundant AC and DC power supply options add superior high availability and serviceability. Foundry is the first to bring this level of serviceability, availability, and comprehensive features to a compact high-density stackable switch.

### HIGHLIGHTS

- ▶ Based on Foundry's 3rd generation JetCore ASIC chipset - Advanced features at wire speed

- ▶ 48 10/100 ports and 2 Gigabit Ethernet ports (mini-GBIC) consuming just 1.5 rack units - Industry's smallest footprint
- ▶ Integrated ASIC based wire-speed bandwidth management, network monitoring and traffic accounting
- ▶ Hot swappable, internal, redundant load sharing AC or DC power supplies - Industry's first in a stackable form factor
- ▶ Ships with full Layer 2 and base Layer 3 - Upgradeable to full Layer 3 including IP, IPX, AppleTalk, OSPF and BGP4

## Key Features and Benefits

### HIGH PERFORMANCE 10/100 AGGREGATION

FastIron 4802 delivers the highest available switching performance in the industry's smallest 48-port 10/100 footprint, providing the richest feature set available in a fixed configuration switch product. Full ASIC based implementation of Layer 2/3 functions, Access Control Lists (ACLs) and Rate Limiting features makes the FastIron 4802 a perfect fit for deployment to the net-

Friday, June 18, 2010



work edge for Enterprise and Service Provider facilities. Consistent with all Foundry products, FastIron 4802 continues Foundry's price/performance leadership with a wire-speed, non-blocking architecture that provides a total of 34 Gbps of switching capacity and 10.1 million packets per second switching performance.

#### **SUPERIOR AVAILABILITY AND SERVICEABILITY**

FastIron 4802 is the first 1.5U high stackable switch to support modular redundancy and high availability features including dual, load sharing, internal AC and DC hot swappable power supplies, hot swappable mini-GBIC interfaces and a full complement of Layer 2/3 redundancy features.

The ability to provide chassis-class availability and serviceability in a stackable form makes the FastIron 4802 a perfect fit for Enterprise networks deploying mission-critical applications such as Voice over IP (VoIP), and Service Provider networks that require superior network availability to their customers. The FastIron 4802's optional SX or LX Gigabit interfaces, which can range up to 5 km, enable Enterprise campus and Service Provider networks to easily connect customers over a wide range of distances.

#### **COMPREHENSIVE LAYER 2 AND LAYER 3 SWITCHING FEATURES**

FastIron 4802 provides an array of advanced Layer 2 features including extensive support for dynamic VLANs, and rich QoS features. Redundant, load-sharing, hot-swappable power supplies ensure continuous functioning for mission critical Enterprise networks in case of a power supply failure.

Network administrators can use dynamic VLANs to simplify network address administration and increase available bandwidth by logically assigning users to virtual communities of interest based on a port, protocol, subnet, or 802.1q priority. Support for IP, IPX, AppleTalk and multicast protocols including PIM-DM, PIM-SM and IGMP make the FastIron 4802 an ideal choice for Enterprise wiring closet deployments supporting legacy, current and future applications including VoIP and multimedia content.

#### **SUPERIOR ASIC BASED QOS**

Preparing for the next generation of applications, including VoIP, requires a combination of available bandwidth to allow minimal latency, jitter and packet loss, while supporting traffic prioritization. By utilizing Foundry's JetCore ASIC, the FastIron 4802 can enforce existing traffic priority settings based on 802.1p, Type of Service (ToS) or DiffServ settings, as well as set traffic priority based on port or traffic type using ACLs.

#### **SUPERIOR SCALABILITY**

Shipping with full Layer 2 and base Layer 3 switching capabilities,

FastIron 4802 is software upgradeable to support full Layer 3 functionality. Foundry is raising the bar for scalability in high-density stackable switches with support for a BGP implementation that can store and process the full Internet routing table. Integrated granular bandwidth provisioning empowers Service Providers to deploy the FastIron 4802 as an access device for on-demand bandwidth provisioning, turning bandwidth into a profitable revenue stream.

#### **WIRE-SPEED GRANULAR BANDWIDTH MANAGEMENT**

Using the FastIron 4802's integrated ASIC-based granular Rate Limiting and traffic accounting feature set, Service Providers can guarantee Service Level Agreements (SLAs) to their customers and turn bandwidth into a profitable revenue stream. The FastIron 4802 delivers the industry's first wire speed, ASIC based Rate Limiting functionality in a stackable form factor, which is achieved through the use of Foundry's next generation JetCore ASIC. Administrators can allocate up to 128 predefined bandwidth profiles on specific ports or applications. Foundry's IronClad Rate Limiting enables administrators to control the amount of bandwidth, from 1 Mbps to 1 Gbps in 256 Kbps increments. Service Providers can use the FastIron 4802 to provide 10/100 Ethernet access to their customers while metering and measuring the bandwidth to enforce SLAs.

#### **EXTENSIVE NETWORK MONITORING, ACCOUNTING, AND BILLING**

In a technology partnership with Hewlett Packard, Foundry's has integrated HP's patented Extended RMON Sampling Technology within the JetCore ASIC. Incorporating this technology within the JetCore ASIC allows the FastIron 4802 to deliver rich traffic statistics at network speeds up to line rate, without impacting the performance of the switch. These statistics include:

- ▶ *Port-based byte accounting*
- ▶ *MAC-based accounting and traffic matrix based on MAC addresses*
- ▶ *Inter-VLAN accounting*
- ▶ *IP subnets, IP addresses, and IP traffic matrix*
- ▶ *ICMP-based, TCP-based and/or UDP-based level accounting*
- ▶ *AS-based accounting and AS path analysis*

#### **IRONSHIELD SECURITY**

Foundry Networks products offer hardware-based wire-speed Access Control Lists (ACLs), which enable network administrators to add granular bandwidth control and security by applying permit or deny filters on traffic based on source and destination IP address, IP protocol information, or TCP or UDP protocol information. You can configure the following types of ACLs:

- ▶ *Standard* - Permits or denies packets based on source IP address.
- ▶ *Extended* - Permits or denies packets based on source and destination IP address and based on IP protocol information. These extensions include:
  - Source/destination host names
  - IP subnet and range
  - Source/destination TCP or UDP port/socket
  - Well-known port numbers (0 -1023)

For easy migration, it is possible to cut/copy/paste from Cisco ACLs into Foundry FastIron 4802 ACLs. In addition to ACLs, the FastIron 4802 adds security features that protect the network against Denial of Service (DoS) conditions such as TCP SYN or Smurf attacks. These features help by eliminating unnecessary network downtime caused by malicious hacker attacks.

#### EASY-TO-USE, SIMPLE NETWORK MANAGEMENT

The FastIron 4802 delivers ease of use and lowers the total cost of ownership by supporting Foundry's familiar Command Line Interface (CLI), which is common across the entire Foundry product lines, to minimize the amount of training required. The Web-based management interface is standard on all Foundry products and allows easy point-and-click configuration.

Using Foundry's optional IronView network management system, network administrators can keep track of Foundry inventory connected to their network, manage configuration changes, and provide automated backups, as well as and configure VLANs, ACLs, and Image updates - all remotely. FastIron 4802 also supports management using third-party SNMP-based Network Management Systems.

## FastIron 4802 Deployment Applications

#### FASTIRON 4802 FOR ENTERPRISE WIRING CLOSETS

FastIron 4802 is an ideal choice for Enterprise wiring closets because of its port density, price, superior serviceability, high availability, security and advanced Layer 2/3 feature sets. FastIron 4802 provides an array of advanced Layer 2 features including extensive support for dynamic VLANs, and rich QoS features based on 802.1p, Type of Service (ToS), and DiffServ. Redundant, load-sharing, hot-swappable power supplies ensure continuous functioning for mission critical Enterprise networks in case of a power supply failure.

*Superior ASIC Based QoS:* Preparing for the next generation of applications, including VoIP, requires a combination of available bandwidth to allow minimal latency, jitter and packet loss, while supporting traffic prioritization. By utilizing Foundry's JetCore ASIC, the FastIron 4802 can enforce existing traffic priority set-

tings based on 802.1p, Type of Service (ToS) or DiffServ settings, as well as set traffic priority based on port or traffic type using ACLs.

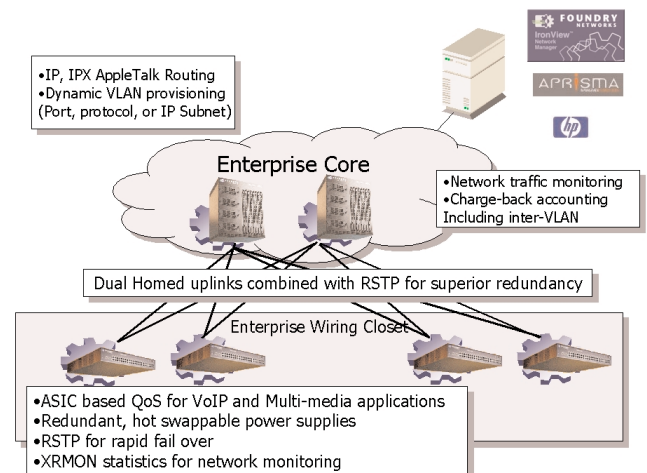
*Superior Investment Protection:* While the base configuration for FastIron 4802 provides full Layer 2 with base Layer 3 features, Enterprise customers can protect their investment with a simple software upgrade to get full Layer 3 functionality including support for OSPF and a comprehensive multicast feature set. This provides Enterprise customers with a compact stackable Layer 2/3 switch that can run next-generation applications such as VoIP and streaming media.

*Rapid Spanning Tree Protocol:* Based on the industry standard 802.1w for fast spanning tree convergence, Foundry's Rapid Spanning Tree Protocol (RSTP) capability delivers sub-second convergence, dramatically reducing downtime and packet loss in high-availability networks. Foundry's RSTP provides seamless Layer 2 failover by instantly switching over to a secondary link if the primary link fails.

*IronShield Security:* The FastIron product family provides extensive security features including Secure Shell and Secure Copy to guard the administration and management interface. Foundry's ACL implementation enforces access policies while providing high performance switching and routing. Foundry's ACL syntax compatibility with other major vendors enables Enterprises and Service Providers to maintain a common set of security policies that can be applied across vendor platforms.

*Comprehensive Network Management:* All FastIron products come with comprehensive network management options that include a Command Line Interface, Simple Network Management Protocol (SNMP) based device management, and a Web-based Graphical User Interface. Using Foundry's IronView Network Manager software, all Foundry products can be configured and managed from a central location.

FIGURE 1 - ENTERPRISE SOLUTION



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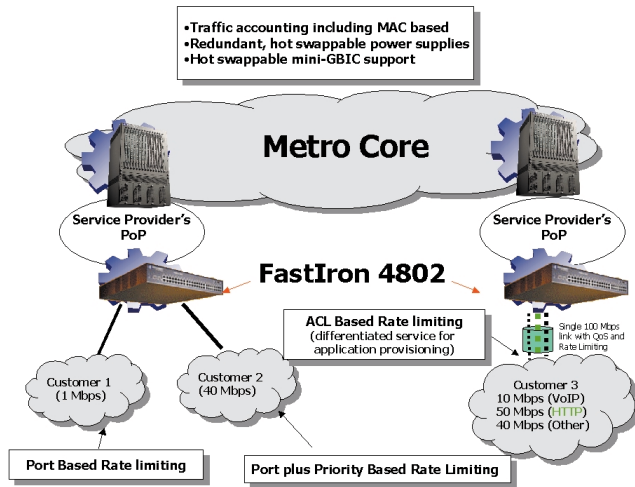


FIGURE 2 - METRO SOLUTION

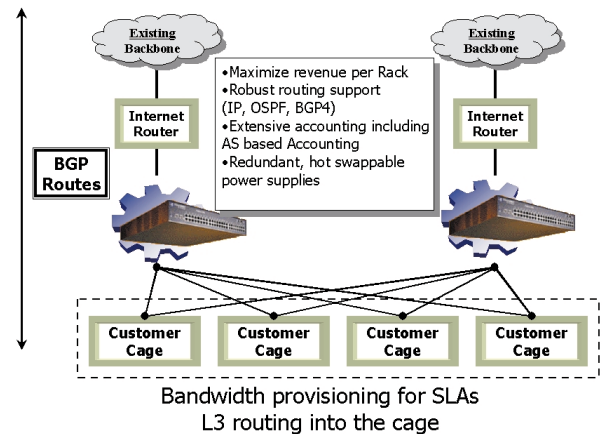


FIGURE 3 - COLLOCATION SOLUTION

*Support for Multiple Protocols:* Foundry's FastIron product family integrates ASIC based support for multiple protocols, including IP, IPX, OSPF and AppleTalk, ensuring smooth interoperability among diverse clients.

#### METROPOLITAN AREA NETWORK ACCESS DEVICE

With its granular bandwidth provisioning, port density, availability, scalability and serviceability, FastIron 4802 provides Metro Service Providers with a quick return on investment. FastIron 4802 is the first in its class to deliver granular bandwidth provisioning features, including adaptive Rate Limiting, that allow Metro Service Providers to provision bandwidth on-demand from 1 Mbps to 1 Gbps, in increments as little as 256 Kbps. Foundry's adaptive Rate Limiting allows Service Providers to set normal and burst limits for bandwidth and apply the bandwidth policies to a physical port, a group of ports, or to Layer 3/4 traffic flows or sessions identified by ACLs. This provides the flexibility and control needed by Metro Service Providers to identify customer traffic and apply the associated bandwidth policies. With mini-GBIC based interfaces, Metro Service Providers get the flexibility to use Gigabit SX or LX interfaces to connect Metro Points of Presence (PoP) to customer premises.

#### CO-LOCATION NETWORK ACCESS DEVICE

FastIron 4802 is an ideal choice for Co-Location Service Providers to provide 10/100 Mbps access to the customer racks and provide SLAs to apply bandwidth policies. Its compact form factor, consuming just 1.5 rack units for 48 10/100 and 2 Gigabit ports, enables Co-Location Service Providers to maximize the revenue per rack unit in data centers where space is at a premium.

## Rich Feature Set

### LAYER 2 FEATURES

- ▶ 802.3ad Trunk Groups
- ▶ 802.1d Spanning Tree Support
  - Enhanced IronSpan support including Fast Port Span, Fast Uplink Span, Single-instance Span
- ▶ Rapid Spanning Tree support
  - Allows for sub-second convergence
- ▶ 802.1p queue mapping for QoS
  - Weighted Fair Queuing (WFQ)
  - Strict Priority (SP)
- ▶ VLAN Support
  - 802.1q with Tagging
  - Subnet-based VLANs
  - Dynamic VLANs based on Port, Protocol or Subnet
- ▶ MAC Filtering and Address-lock Filters to enhance network security
- ▶ Dynamic Host Configuration Protocol (DHCP) Assist

### LAYER 3 SWITCHING FEATURES

- ▶ Protocol-based VLANs
  - AppleTalk, IP, IPX, DECnet, NetBIOS, or other protocol types.
- ▶ IP / IPX Router Acceleration

### LAYER 3 ROUTING FEATURES

- ▶ IP / IPX Multi-netting
  - Support for multiple IP or IPX addresses per interface
- ▶ IP Routing Support
  - RIP, RIP2, OSPF and BGP4

- ▶ *Policy Based Routing (PBR)*
  - *Use ACLs and route maps to selectively modify and route IP packets based on their source IP address.*
- ▶ *IP Access and QoS Filters*
- ▶ *UDP Helper*
- ▶ *Full multiprotocol routing support*
  - *IP, IPX, AppleTalk*
- ▶ *Multicast support*
  - *PIM-SM, PIM-DM, DVMRP, PIM Snooping*
- ▶ *Policy-based Traffic Classification on:*
  - *ToS (Type of Service)*
  - *IP precedence mappings*
  - *Layer 2/3/4 defined traffic flows*
- ▶ *VRRP and VRRPE support*
- ▶ *FSRP*

#### GENERAL FEATURES

- ▶ *IronClad Rate Limiting, based on next- generation JetCore ASIC*
  - *Provision bandwidth on-demand from 1 Mbps to 1 Gbps in increments as little as 256 Kbps*
- ▶ *Hot-swappable, Load-sharing AC / DC Power Supply Options*
  - *Support for AC & DC power supplied simultaneously, allowing power source redundancy*
- ▶ *Extensive Management Options:*
  - *Industry Standard Command Line Interface (CLI)*
  - *IronView Network Management (Stand alone and HP OpenView GUI)*
  - *Telnet*
  - *Web Browser-based GUI*
- ▶ *Robust security and wire-speed Access Control Lists (ACLs) and Extended ACLs for:*
  - *Denial of Service (DoS) protection from*
- ▶ *SYN Attacks*
- ▶ *Smurf Attacks*
  - *RADIUS, TACACS/TACACS+ Authentication*
  - *Multiple SysLogD Server Logging*
- ▶ *Wire speed Rate Limiting*
  - *Fixed Rate Limiting*

## Technical Specifications

#### PERFORMANCE:

Up to 10,100,000 packets per second

#### SWITCHING CAPACITY:

Up to 34 Gbps

#### STANDARDS COMPLIANCE:

802.3, 10BaseT  
 802.3u 100BaseTX  
 802.3z 1000BaseSX  
 802.3z 1000BaseLX  
 802.3x Flow Control  
 802.1p/q VLAN Tagging  
 802.1d Bridging  
 802.3 Ethernet Like MIB  
 Repeater MIB  
 Ethernet interface MIB  
 SNMPV1,V2c  
 SNMP MIB II

#### PROTOCOL SUPPORT:

BGP4 (RFC 1771, RFC 1745, and RFC 1997)  
 IP (RFC 1812)  
 RIP (RFC 1058)  
 RIPV2 (RFC 1723)  
 OSPF (Interoperability with RFC 1583 and RFC 2328V2)  
 OSPF Traps (RFC1850)  
 IPX/RIP/SAP  
 AppleTalk  
 IGMP (RFC 1112)  
 DVMRPV3  
 VRRP (RFC 2338)  
 Foundry Standby Router Protocol (FSRP)  
 DNS Client  
 PIM Dense and Sparse Mode (RFC 2362)  
 ICMP Router Discovery Protocol (RFC 1256)  
 BGP4 (RFC 1771)  
 BGP4/IDRP for IP - OSPF Interactions (RFC 1754)  
 BGP3 MIB (RFC 1269)  
 IP forwarding table MIB (RFC 1354)  
 TFTP (RFC 783)  
 BootP (RFC 1542)  
 BootP (RFC 951)  
 Telnet (RFC 854)  
 RMON Groups 1,2,3,9 (RFC 1757)  
 HTTP (RFC 2068)  
 BootP/DHCP Relay (RFC 2131)

#### NETWORK MANAGEMENT:

Integrated Command Line Interface  
 Telnet

SNMP  
RMON  
HP OpenView for Sun Solaris, HP-UX, IBM's AIX, and  
Windows NT  
Standalone Windows NT  
Embedded HTTP (supports Netscape or Internet Explorer  
browsers)

**ELEMENT SECURITY OPTIONS:**

AAA  
Radius  
Secure Shell (SSH v1)  
TACACS/TACACS+  
Username/Password (Challenge and Response)  
Bi-level Access Mode (Standard and EXEC Level)  
Repellant for TCP SYN or Denial of Service or Smurf Attacks

**PHYSICAL DIMENSIONS:**

2.75"h x 17.5"w x 18.64"d (7.0 x 44.5 x 47.3 cm)  
Weight: 23.5 lbs fully loaded (10.55 kgs)

**POWER REQUIREMENTS:**

100VAC @ 3.5A, 240 VAC @ 1.5A, 50-60Hz per auto-sensing,  
auto-switching power supply

**ENVIRONMENTAL:**

Operating Temperature: 32-104 deg-F (0-40 deg-C)  
Relative Humidity: 5-90%, non-condensing  
Maximum BTUs: 340\* BTU/Hr (100 W)  
Storage Temperature: -25 - 70deg-C (-13 to 158deg-F)  
Storage Humidity: 95% maximum, non-condensing  
Storage Altitude: 10,000 ft(3,000 m) maximum

**SAFETY AGENCY APPROVALS:**

EN 60950/IEC 950  
UL 1950  
CSA 950

**ELECTROMAGNETIC EMISSION CERTIFICATION**

FCC Class A  
EN 55022/CISPR-22 Class A;VCCI Class A

**IMMUNITY:**

Generic: EN 50082-1

**WARRANTY:**

1-year hardware  
90-day software  
Mounting Options

Specifications subject to change without notice

**APPENDIX BB**

**Not Used**

**APPENDIX CC****Interior Colors**

While pertinent and required portions of the Installation Design Guide have been included as Appendices herein, there is much additional information, including information about interior colors, that may be of use to the designer of this project through the process. Designers are invited to request this document during the design stage of the project.

**APPENDIX DD**

**Not Used**

Information originally proposed for insertion here has been deleted and this appendix section is not being used.

Not Used

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**APPENDIX EE**

**Not Used**

Information originally proposed for insertion here has been deleted and this appendix section is not being used.

**APPENDIX FF**

**Not Used**

Information originally proposed for insertion here has been deleted and this appendix section is not being used.

Not Used

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**APPENDIX GG**

**IDG Checklist**

Because not all portions of the IDG are requirements of this Contract, some of the checklist questions will need to be left blank. But, those portions that refer to Contract requirements are to be filled out and submitted.



**The following 'Design Team IDG Checklist' will be completed by the Design Team for all new construction, major renovation, maintenance, or other projects that impact the appearance of Fort Hood.**

The Chief of Master Planning shall provide the checklist to all teams designing new facilities, additions, or renovations to existing facilities, or maintenance on the installation. All components of the Design Team IDG Design Checklist are to be completed by the Design Team to assure the guidelines and standards have been considered and complied with in the design process, and by the Chief of Master Planning in project review. For more information on this checklist, see Section 2 of the IDG.

ARMY INSTALLATION DESIGN GUIDE (IDG) COMPLIANCE CHECKLIST

1. PROJECT TITLE AND DESCRIPTION

Title: \_\_\_\_\_

Description: \_\_\_\_\_

2. PROJECT JUSTIFICATION: \_\_\_\_\_

3. SUSTAINABLE DESIGN:

- a. Does the project meet or exceed the U.S. Green Building Councils LEED-NC Silver level for new construction or major renovation projects?
- Yes \_\_\_\_\_ - Review project as submitted.
- No \_\_\_\_\_ - Return submittal to design team for revisions to meet LEED-NC Silver or attach appropriate waivers.
- b. Are project Waivers from the IDG necessary?
- Yes \_\_\_\_\_ - If yes, provide waiver explanation for consideration and for the project record.
- No \_\_\_\_\_

4. SITE PLANNING

- a. Was a site plan prepared for the proposed project utilizing the Site Analysis Process identified in Section 7.3 of the IDG?
- Yes \_\_\_\_\_ No \_\_\_\_\_
- b. Does site planning comply with the standards identified in this IDG? If not, provide justification.

c. Does the site plan meet antiterrorism/force protection (AT/FP) requirements identified in Section 12 of the IDG?

Yes \_\_\_\_\_ No \_\_\_\_\_

d. Does site planning meet approved installation Master Plan siting compliance?

Yes \_\_\_\_\_ No \_\_\_\_\_ If not, provide justification.

\_\_\_\_\_

\_\_\_\_\_

e. Designer comments on site planning:

\_\_\_\_\_

\_\_\_\_\_

f. Has the proper NEPA actions been initiated for the construction effort in accordance with AR 200-2?

Yes \_\_\_\_\_ No \_\_\_\_\_

h. Does the project impact airspace use relative to:

- Airfield accident potential zones? Yes \_\_\_\_\_ No \_\_\_\_\_
- Noise zones? Yes \_\_\_\_\_ No \_\_\_\_\_
- Obstacle height requirements in the airfield surface clear zone? Yes \_\_\_\_\_ No \_\_\_\_\_
- Any Federal Aviation Administration (FAA) regulations which may restrict project siting? Yes \_\_\_\_\_ No \_\_\_\_\_

5. BUILDINGS

- a. Does the building exterior design meet the building design objectives defined in the IDG?  

Yes \_\_\_\_\_ No \_\_\_\_\_
- b. Is the exterior building designed to meet the structural and sustainable material characteristics defined in the IDG?  

Yes \_\_\_\_\_ No \_\_\_\_\_
- c. If the project is a renovation or addition, does the proposed renovation or addition meet IDG building design and structural and sustainable material characteristics?  

Yes \_\_\_\_\_ No \_\_\_\_\_
- d. If the project is a renovation or addition to a historic building, does the renovation or addition maintain the design integrity of the original building or meet Historical Approval Agencies' requirements for any deviations?  

Yes \_\_\_\_\_ No \_\_\_\_\_
- e. Does the building exterior design meet AT/FP requirements (if applicable)?  

Yes \_\_\_\_\_ No \_\_\_\_\_
- f. Designer comments on exterior building design:
- g. Does building design comply with the IDG? If not, provide justification.

6. CIRCULATION

- a. If the project includes roadway construction, does the proposed plan meet federal highway and/or local guidelines defined in the IDG?  
Yes \_\_\_\_\_ No \_\_\_\_\_
- b. If the project includes roadway construction, does the proposed plan meet AT/FP roadway setback requirements defined in the IDG?  
Yes \_\_\_\_\_ No \_\_\_\_\_
- c. If the project includes roadway construction, does the proposed plan include applicable roadway alignment and intersection guidelines defined in the IDG?  
Yes \_\_\_\_\_ No \_\_\_\_\_
- d. Have potential impacts to existing roadway and intersection capacity been considered?  
Yes \_\_\_\_\_ No \_\_\_\_\_
- e. If the project is an entrance gate, does the proposed plan include entrance gate guidelines and standards defined in the IDG?  
Yes \_\_\_\_\_ No \_\_\_\_\_
- f. If the project includes parking, does the proposed plan meet the parking lot location/design guidelines defined in the IDG?  
Yes \_\_\_\_\_ No \_\_\_\_\_
- g. If the project includes pedestrian circulation, does the proposed plan meet the walkways and pedestrian circulation guidelines in the IDG?  
Yes \_\_\_\_\_ No \_\_\_\_\_
- h. If the project includes bicycle circulation, does the proposed plan meet the bikeway guidelines in the IDG?  
Yes \_\_\_\_\_ No \_\_\_\_\_



i. Designer comments on circulation design:

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j. Does circulation design comply with the IDG? If not, provide justification.

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7. Landscape Design

a. All projects for new construction require a landscaping design plan for the planting of trees shrubs and/or groundcover. Does the landscape design comply with the IDG?

Yes \_\_\_\_\_ No \_\_\_\_\_

b. Has the plan for this been reviewed by the Fort Hood agronomist?

Yes \_\_\_\_\_ No \_\_\_\_\_

c. Does the proposed plan meet AT/FP requirements defined in the IDG?

Yes \_\_\_\_\_ No \_\_\_\_\_

d. Does the proposed landscape design plan include plant material recommended in the selected plant palette matrix (Appendix N) included in the IDG?

Yes \_\_\_\_\_ No \_\_\_\_\_

e. Designer comments on landscape design:

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8. SITE ELEMENTS

a. Does site elements design comply with IDG?

Yes \_\_\_\_\_ No \_\_\_\_\_ If not, provide justification:

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b. If the project includes site furnishings, does the proposed plan follow the guidelines in the IDG, including the guidelines for sustainable materials?

Yes \_\_\_\_\_ No \_\_\_\_\_

c. If the project includes signs, does the proposed plan meet the signs standards in the IDG.

Yes \_\_\_\_\_ No \_\_\_\_\_

d. If the project includes exterior lighting, does the proposed plan meet the exterior lighting guidelines defined in the IDG?

Yes \_\_\_\_\_ No \_\_\_\_\_

e. Will all power and other distribution lines be located underground?

Yes \_\_\_\_\_ No \_\_\_\_\_

f. Will all substations and transformers be designed so they are screened from view?

Yes \_\_\_\_\_ No \_\_\_\_\_

g. Will all sewer and water lines be located underground?

Yes \_\_\_\_\_ No \_\_\_\_\_

h. Are all storm drain systems designed to meet the guidelines defined in the IDG?

Yes \_\_\_\_\_ No \_\_\_\_\_

i. Are all utilities (gas, water, electric) metered to the building with an electrical monitoring connection to a meter interface?

Yes \_\_\_\_\_ No \_\_\_\_\_ If not, provide justification:

j. Has transient voltage surge suppression been furnished for all buildings having voltage-level sensitive electronic equipment such as computers?

Yes \_\_\_\_\_ No \_\_\_\_\_ If not, provide justification:

k. Designer comments on site elements design:

9. Anti-Terrorism/Force Protection Design Standards

a. Does Anti-Terrorism/Force Protection (AT/FP) design comply with the IDG?

Yes \_\_\_\_\_ No \_\_\_\_\_ If not, provide justification:

b. Have building setbacks from roads, parking, other buildings been included?

Yes \_\_\_\_\_ No \_\_\_\_\_

c. Do site plans and landscape plans include the criteria outlined for AT/FP?

Yes \_\_\_\_\_ No \_\_\_\_\_

d. Have Fort Hood's Security and Force Protection personnel been consulted?

Yes \_\_\_\_\_ No \_\_\_\_\_ If not, provide justification:

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e. Designer comments on AT/FP compliance:

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10. CORROSION PREVENTION AND CONTROL

a. Has corrosion prevention and control been considered and included as a part of sustainable design in this project?

Yes \_\_\_\_\_ No \_\_\_\_\_ If not, provide justification:

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b. Has corrosion prevention and control been considered and included in the Life Cycle Cost Analysis (LCCA) for this project?

Yes \_\_\_\_\_ No \_\_\_\_\_ If not, provide justification:

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I hereby certify that the information provided is in compliance with the guidelines of the installation or applicable IDG, except as justified as non-compliance.

Designer of Record		
	Date	
Concur	Deny	Explanation of denial is attached.
IDG Coordinator		
	Date	
Accept	Deny	Explanation of denial is attached.
Command Review (Where Applicable)		
	Date	

**APPENDIX HH**

**Not Used**

Information originally proposed for insertion here has been deleted and this appendix section is not being used.

Not Used

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**APPENDIX II****SPECIAL FORT HOOD REQUIREMENTS**

The following sections are required to be incorporated into Specifications of this task order and are attached. These sections are available in a SpecsIntact .sec format. These sections will be made available upon request after award of the task order.

01 35 10.00 44	SPECIAL PROJECT PROCEDURES FOR FORT HOOD
01 57 20.00 10	ENVIRONMENTAL PROTECTION
01 57 23	TEMPORARY STORM WATER POLLUTION CONTROL
01 57 24.01 44	STORM WATER POLLUTION PREVENTION PLAN (TEXAS)
01 57 25.00 44	SWPP PLAN INSPECTION AND MAINTENANCE REPORT FORM
01 74 19	CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

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## SECTION 01 35 10.00 44

## SPECIAL PROJECT PROCEDURES FOR FORT HOOD

06/2010

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- 1.3 FORT HOOD CADD AND GIS DELIVERABLES
  - 1.3.1 Data Standards
  - 1.3.2 Coordinate System Projection And Datum
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## PART 2 PRODUCTS (NOT APPLICABLE)

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-- End of Section Table of Contents --

## SECTION 01 35 10.00 44

SPECIAL PROJECT PROCEDURES FOR FORT HOOD  
06/2010

## PART 1 GENERAL

This Section covers the project requirements unique to Fort Hood, Texas. These unique requirements relate to items such as the digging permit process; use of Fort Hood airfields; tracer wire and marking tape specifications for the location of utility systems; Fort Hood landfill operations and permit requirements; local jacking, boring, and tunneling requirements; backflow prevention assembly documentation; and Customer Service Inspection certifications.

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C651 (2005; Errata 2005) Standard for  
Disinfecting Water Mains

AWWA C652 (2002) Disinfection of Water-Storage  
Facilities

## U.S. ARMY (DA)

DA AR 200-1 (2007) Environmental Protection and  
Enhancement

## ASTM INTERNATIONAL (ASTM)

ASTM A 53/A 53M (2007) Standard Specification for Pipe,  
Steel, Black and Hot-Dipped,  
Zinc-Coated, Welded and Seamless

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 112 Oil Pollution Prevention

40 CFR 279 Standards for the Management of Used Oil

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

### Casing Pipe

10 days prior to jacking, boring, and tunneling activity, furnish catalog data for casing pipe.

### Paint Usage and Material Safety Data Sheet (MSDS)

Submit two copies of all paint systems for this contract and the associated MSDS. One copy for the Contracting Officer Representative (COR) and the other copy for the Air Quality Manager (telephone, 254-287-5284), DPW Environmental Division.

### Air Emission Inventory

Submit a copy of air emission inventory Air Program Manager on each type of mechanical equipment and the number of units to be installed for the new facility to facilitate annual revision of Federal Air Permit Title V. The Contractor use the manufacturer equipment information to prepare submittal of Air Emission Inventory.

### Backflow Prevention Assembly;

A list of backflow prevention devices installed for this project shall be provided to DPW-Services Division (David Somerville, 254 287-9606). The list shall identify all devices (the type, size, location and purpose of what system it is protecting)

### Vacuum Breakers

Add vacuum breakers to all hose bibs installed in the Contract. See SD-07 submittal description "Backflow Prevention Assembly Tests."

## SD-04 Samples

### Plastic Marking Tape and Tracer Wire; G

10 days prior to installation of utilities, furnish 12 inch long samples of marking tape for each applicable utility. Furnish 12 inch long sample of the tracer wire.

## SD-07 Certificates

### Customer Service Inspections

The Contractor shall supply a "Customer Service Inspection" (CSI) certificate for the water supply in accordance with the Texas Commission on Environmental Quality (TCEQ) regulations. Prior to final inspection and acceptance of new construction or after any material improvement or addition to drinking water systems, furnish the completed and signed certificate to Jack Shackelford of American Water at 254-258-5324, through the Contracting Officer, for review and final approval. A blank certificate is located at the end of this section. See paragraph CUSTOMER SERVICE INSPECTIONS for additional information.

### Digging And Water Use Permits

Digging permits must be obtained prior to any digging, drilling or excavation. See paragraph DIGGING PERMITS for additional information.

### Fort Hood Airfield Use

Installation Airfield use is prohibited unless DA Forms 5205-R, 5206-R and 5207-R are completed, submitted and approved. See paragraph FORT HOOD AIRFIELDS for additional information.

### Landfill Permit

Contractor shall obtain permission from Fort Hood Directorate of Public Works (DPW) to use the Fort Hood landfill. Submit documentation granting permission and a completed landfill permit to the Contracting Officer prior to start of construction. A blank permit form is located at the end of this section. See paragraph CONDITIONS FOR USE OF FORT HOOD LANDFILL for additional information.

### Backflow Prevention Assembly Tests

Certification of proper operation of backflow preventers shall be accomplished in accordance with state regulations by an individual certified by the state to perform such tests. If no state requirement exists, the Contractor shall have the manufacturer's representative test the device to ensure the unit is properly installed and performing as intended. Prior to start of construction, provide a list of backflow prevention devices that will be installed for this project to DPW-Services Div (David Somerville, 287-9606). Include the BPD type, size, location and purpose (what system it's protecting) for DPW records. Add vacuum breakers to all hose bibs installed in the Contract. At the time of the final inspection for the facility, the Contractor shall provide written documentation, including the original BPD test record and TCEQ Appendix F form, that the tests have been performed and that the backflow preventors operate properly. The ORIGINAL of the signed and dated forms and documents will be retained by Fort Hood DPW-Service Division (David Somerville).

A copy of the TCEQ rule and sample of the form ("Appendix F Sample Backflow Prevention Assembly Test and Maintenance Report" ) can be obtained from the TCEQ's home page at the web site: <http://163.234.20.106/index.html> or [http://info.sos.state.tx.us/fids/30\\_0290\\_0047-23.html](http://info.sos.state.tx.us/fids/30_0290_0047-23.html).

### Certification of Natural Gas Heating Equipment

The Contractor shall comply with the Texas Commission on Environmental Quality (TCEQ) air emission requirement for water heaters, small boilers and process heaters. Submit a document or certificate to verify that the natural gas-fired heating equipment having a maximum rated rating capacity of 2.0 million British Thermal Units per hour (MBtu/hr) or less is in compliance with the Nitrogen Oxide limits as specified in 30 Texas Administrative Code (TAC), Part 1, Chapter 117,

Subchapter D, division 1, Rule 117.465.

Waste Diversion Report; G

Submit the Waste Diversion Report to the Installation's Solid Waste Program Office in accordance with this Section.

Dechlorination of Superchlorinated New Water Supply System; G

Submittal on method of dechlorination in accordance with paragraph RECYCLING AND SOLID WASTE MINIMIZATION, this Section.

Dechlorination Method of Wastewater from Disinfecting Water Line and Water Storage Tanks; G

Submittal of dechlorination method and location for discharge of wastewater from disinfection of waterline and water tank.

Certificate of Proof on Asbestos Free Construction Material and Material Safety Data Sheet (MSDS) for Construction Materials and Products; G

Submittal of a certificate of proof on asbestos free construction (per TAC 295.34 j) shall provide to the DPW-ENV office and also no other regulated materials. An Asbestos Certification form is appended to this Section. Also include MSDS of all construction materials and products to DPW-ENV Hazardous Materials Office.

Potable Water Lines

Provide copies of results of bacteriological (bac-t) testing when placing new potable water lines in service.

List of Regulated Material On-site and MSDS

Submittal of regulated materials list and MSDS to DPW-ENV.

1.3 FORT HOOD CADD AND GIS DELIVERABLES

1.3.1 Data Standards

Spatial Data Standard for Facilities, Infrastructure and Environment (SDSFIE) current release shall be followed for Geospatial database structure and attributes to allow for data integration. CADD data shall be documented according to the current release of the Architecture, Engineering and Construction (AEC)/CADD standards. All GIS and CADD data will be documented in accordance with the Federal Geographic Data Committee (FGDC) Content Standards for Digital Geospatial Metadata. Deviations from the standard described above will be rejected.

1.3.2 Coordinate System Projection And Datum

All GIS data shall use the Universal Transverse Mercator Zone 14 North projection, World Geodetic System of 1984 (WGS84) datum, and the North American Vertical Datum of 1988 (NAVD88) using Metric as the working units to ensure data alignment and accuracy.

CADD data shall be geo-referenced in the State Plane Coordinate System

1983, using the North American 1983 Geodetic Datum with Survey Feet as the working units.

The projection, datum and coordinate system must be defined and then documented in the metadata for both CADD and GIS and provided whenever the data is distributed.

#### 1.3.3 CADD And GIS Deliverables

All CADD deliverables of As-built drawings shall be delivered in a MicroStation V8 .DGN compatible format.

All CADD references shall be removed from the submitted DGN file.

Files with raster's attached as the sole contents of the file are not acceptable. DGN files with vector edits made over an attached raster will be accepted.

Individual as-built sheets have one to one correspondences to individual dgn files.

Each dgn file will be named in such a way to easily reflect the order and As-Built sheet it represents.

A seed file can be obtained from the Fort Hood DPW CADD/GIS Center. If a seed file other than the Fort Hood seed file is used, the contractor must provide a copy of the file with the submittal.

GIS deliverables shall be delivered in current Bentley file format or an ArcGIS shape file format.

Contact: Fort Hood DPW CADD/GIS Center (254) 285-6851.

#### 1.4 FORT HOOD AIRFIELD USE

Contractors performing work under this contract may use airfields at Fort Hood with prior written notification and approval, providing:

a. All requests for Installation Airfield use shall be coordinated through the Office of the Commander, Installation Airfields, AFZF-DPC-AC, Hood Army Airfield, Fort Hood, TX 76544, telephone (254) 287-4266/5838.

b. Potential users shall submit completed DA Forms 5205-R (Certificate of Insurance), 5206-R (Civil Aircraft Landing Permit), and 5207-R (Hold Harmless Agreement). Forms are available through the Point of Contact (POC) mentioned in paragraph (a) above. User requests and specified forms shall be submitted at least 60 days before the first intended landing.

#### 1.5 ENVIRONMENTAL PROTECTION PLAN

The environmental protection plan shall include all elements addressed in Section 01 57 20.00 10 ENVIRONMENTAL PROTECTION, paragraph 1.7.2 "Contents." Include the following:

(a) List of all on-site regulated materials, Material Safety Data Sheet (MSDS), List of Construction Materials and Products (mastic, sealants, etc.), and MSDS shall be submitted through the Contracting

Officer to the installation DPW-Environmental Office Hazardous Material Materials Program Manager.

(b) All required pre-construction permits, registration, notifications, certifications applicable to the Contract.

#### 1.6 SURFACE WATER MANAGEMENT

All construction that requires the storage, obtaining, and diversion surface water flow, except potable water, requires a Temporary Water Use Permit per Texas Water Code (TWC) Chapter 11. The Contractor shall obtain the permit, provide a copy of the permit and monthly reports of total surface water usage to the installation environmental office until project completion and acceptance.

#### 1.7 DIGGING AND WATER USE PERMITS

##### 1.7.1 Digging Permits

The Contractor shall obtain digging permits directly from the Fort Hood Post DPW before any drilling, digging, or excavation is undertaken (254-287-9735). Provide a completed form FHT 200-X10, Coordination for Land Excavation & Water Use, to the DPW building 4612, Fort Hood, Texas for each permit. Allow 30 days for Government review of digging permit requests. A digging permit for a specified area of excavation expires 30 days after the issue date; Contractor must re-apply for a new permit to perform excavation in the area if the excavation was not started within the 30-day period. Permits will identify all underground utilities within 5 feet of the designated area. Contractor shall be responsible for all repairs, costs, and damages due to excavating without permit or damaging an identified utility. Unidentified utilities shall be repaired by the Contractor at Government expense.

All personnel performing the digging, including all subcontractor personnel must be present at the digging permit inspection.

##### 1.7.2 Water Use Permit

Contractor shall obtain a Fort Hood Water Use Permit directly from Fort Hood post DPW prior to any use of surface or ground water on Fort Hood. All usage of surface water or ground water must be coordinated in writing also using Fort Hood 200-X10 with both the DPW Environmental Management Branch and Natural Resources Management Branch, at least 30 days in advance of such a need. The information required includes the proposed use for the water, estimated dates of the operation, estimated amount of water to be used, and desired locations of the water source.

A temporary water use permit from the TCEQ will also be required (<http://www.tnrcc.state.tx.us/permitting/waterperm/wrpa/permits.html#temporary>). Such permits can be anticipated to take a minimum of 30 days and require a \$100 application fee plus other minor application-related expenses.

Any alteration to the stream such as dikes or other modifications involving placing fill in the stream would require a Section 404 Permit application and approval. This process is elaborate and 180 days should be allowed for the process.



## 1.8 UTILITY INSTALLATION REQUIREMENTS

### 1.8.1 Plastic Marking Tape and Tracer Wire

Marking tape to be manufactured with integral wires or foil backing. Furnish and install the following marking tape and tracer wire:

#### a. Plastic Marking Tape

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be of a type specifically manufactured for marking underground utilities. Tape shall be color as specified in Table 1 and bear a continuous printed inscription describing the specific utility.

TABLE 1. Tape Color

Red:	Electric
Orange:	Telephone, Telegraph, Television, Police, and Fire Communications
Yellow:	Gas
Blue	Water
Green	Wastewater

#### b. Tracer Wire

For gas, water, force sanitary sewer mains, gas service lines, water service lines, and other pressurized utility systems, place No.10 AWG, THWN, CU, direct burial in trench bottom prior to sandbedding, and brought up in valve boxes and risers, with 12 inches minimum leads above finished grade. Only direct-burial splices shall be used. Tracer is not required for underground electrical.

### 1.8.2 Jacking, Boring, and Tunneling

Conduct boring and jacking in a manner which does not interfere with the operation of the railroad or street or weakens or damages the embankment or structure. Bore or jack from the low or downstream end wherever possible. Unless otherwise shown or specified, the top of the casing pipe shall be a minimum of 3 feet below the finished road surface and 4 feet below the bottom of the railroad track ballast.

#### a. Utilities

Excavate where possible and verify the location and depth of buried utilities which will be crossed.

#### b. Casing Pipe

Smooth wall steel pipe, ASTM A 53/A 53M with welded joints. Minimum wall thickness of 3/16 inch unless otherwise shown or specified.

#### c. Casing

Unless otherwise indicated or specified, install a casing pipe of a

diameter which provides a minimum of 2 inches clearance between the outside diameter of the carrier pipe joint and the inside wall of the casing. Upon installation of the carrier pipe, sand grout the entire annular space between the casing and carrier pipe walls.

#### 1.8.3 Utility Outages

Coordinate all requests for water and sewer outages with the Contracting Officer in writing 14 days (or more) before the requested outage and limit such outages to 2-hours. Provide changes to other utility types without outages, but submit a safety plan for such changes 14 days (or more) before starting such work.

#### 1.9 POTABLE WATER LINES

When placing new potable water lines in service, provide copies of results of bacteriological (bac-t) testing to Jack Shackelford of American Water at 254-258-5324. Every 1000 feet of installed pipeline requires a negative bac-t result prior to placing in service.

#### 1.10 POLLUTION PREVENTION OF POTABLE WATER SUPPLY SYSTEM

Verification of water line disinfection shall be performed per AWWA C651. The samples shall be analyzed by an analytical lab that holds the current state license and certification. Repeating disinfection protocols are required until satisfactory results are obtained -- that being two consecutive sets of acceptable samples taken 24 hours apart. The water sample analytical results shall be provided to base Environmental Office for record-keeping. One water sample at each 1000 linear feet of disinfected water line shall be obtained. Water sample shall be placed in proper sterilized containers and a bacterial examination shall be performed in accordance with state approved methods. The water supply system shall not approve for service until each test result is negative for bacteria examination.

NOTE: In the State of Texas, new water supply system Certification and drinking water well certification are required. The potable water supply system and water quality shall be in accordance with 30 TAC Chapter 290, subchapter D. In compliance with 30 TAC 290.39, the Contractor shall submit to Texas Commission on Environmental Quality (TCEQ) a written application (with plans, specifications, and related document) for review. The revision period could be 60-day in duration. In addition, the Contractor shall submit the post construction water system completion notification to TCEQ after completion of the new water supply system.

#### 1.11 SPILL CONTROL

POL storage greater than 55 gallons requires modification to the Installation's existing spill prevention control and countermeasures, and are subject to review and approval by the Installation's DPW Environmental Division, state, and local laws and regulations. (NOTE: Reference Spill Response web page at <http://www.tceq.state.tx.us/response/spills.html>, 30 TAC 327 and include RG-285 in the spill Control).

(a) Hazardous substances. The reportable quantities for hazardous substances shall be:

(1) for spills or discharges onto land--the quantity designated as the Final Reportable Quantity (RQ) in Table 302.4 in 40 CFR §302.4; or

(2) for spills or discharges into waters in the state--the quantity designated as the Final RQ in Table 302.4 in 40 CFR §302.4, except where the Final RQ is greater than 100 pounds in which case the RQ shall be 100 pounds.

(b) Oil, petroleum product, and used oil.

(1) The RQ for crude oil and oil other than that defined as petroleum product or used oil shall be:

(A) for spills or discharges onto land--210 gallons (five barrels); or

(B) for spills or discharges directly into water in the state--quantity sufficient to create a sheen.

(2) The RQ for petroleum product and used oil shall be:

(A) except as noted in subparagraph (B) of this paragraph, for spills or discharges onto land--25 gallons;

(B) for spills or discharges to land from PST exempted facilities--210 gallons (five barrels); or

(C) for spills or discharges directly into water in the state--quantity sufficient to create a sheen.

(c) Industrial solid waste or other substances. The RQ for spills or discharges into water in the state shall be 100 pounds

(d) Reportable discharge or spill. A reportable discharge or spill is a discharge or spill of oil, petroleum product, used oil, hazardous substances, industrial solid waste, or other substances into the environment in a quantity equal to or greater than the reportable quantity listed in §327.4 of this title (relating to Reportable Quantities) in any 24-hour period.

(e) Initial notification. Upon the determination that a reportable discharge or spill has occurred, the responsible person shall notify the agency as soon as possible but not later than 24 hours after the discovery of the spill or discharge.

(f) Method of notification. The responsible person shall notify the agency in any reasonable manner including by telephone, in person, or by any other method approved by the agency. In all cases, the initial notification shall provide, to the extent known, the information listed in subsection (d) of this section. Notice provided under this section satisfies the federal requirement to notify the State Emergency Response Commission in the State of Texas. The responsible person shall notify one of the following:

(1) the State of Texas Emergency Response Center at 1-800-832-8224;

(2) during normal business hours only, the regional office for the agency region in which the discharge or spill occurred; or

(3) the agency at the agency 24-hour spill reporting number.

(g) Information required in initial notification. The initial notification shall provide, to the extent known, the information in the following list. Copies of spill reports prepared for other governmental agencies shall satisfy this requirement if they contain, or are supplemented to contain, all the information required by this subsection. The initial notification shall contain:

(1) the name, address and telephone number of the person making the telephone report;

(2) the date, time, and location of the spill or discharge;

(3) a specific description or identification of the oil, petroleum product, hazardous substances or other substances discharged or spilled;

(4) an estimate of the quantity discharged or spilled;

(5) the duration of the incident;

(6) the name of the surface water or a description of the waters in the state affected or threatened by the discharge or spill;

(7) the source of the discharge or spill;

(8) a description of the extent of actual or potential water pollution or harmful impacts to the environment and an identification of any environmentally sensitive areas or natural resources at risk;

(9) if different from paragraph (1) of this subsection, the names, addresses, and telephone numbers of the responsible person and the contact person at the location of the discharge or spill;

(10) a description of any actions that have been taken, are being taken, and will be taken to contain and respond to the discharge or spill;

(11) any known or anticipated health risks;

(12) the identity of any governmental representatives, including local authorities or third parties, responding to the discharge or spill; and

(13) any other information that may be significant to the response action.

In the Spill Control Plan, include the Contracting Officer, facility fire station, facility environmental office, and local authorities in the list of the required reporting channels and telephone numbers.

### 1.12 AIR POLLUTION CONTROL

Provide certifications from equipment manufacturers verifying that the small combustion equipment emission (i.e. with rated capacity less than 2.0 MMBtu/hr) is in compliance with the Texas Commission on Environmental Quality (TCEQ), formerly the TNRCC, per 30 TAC 117.465 (Texas Administrative Code (TAC), Title 30, Chapter 117 Control of Pollution From Nitrogen Compounds, Subchapter D Small Combustion Sources, Division 1 Water Heaters, Small Boilers, and Process Heaters, Rule 117.465 Emission Specifications) and Rule 117.467 Certification Requirements.

Document all equipment emission data from combustion devices to be used in this Contract per 30 TAC 106.183. All equipment air emission data shall be provided to the Installation Air Program Manager to assist revision of the TITLE V Federal Air Permit. An Emission Inventory is included with the Environmental Design Analysis for information only. The Contractor use the manufacturer equipment information to prepare an Emission Inventory based on equipment from the manufacturer, the emission inventory form is attached at the end of this Section. Provide a Refrigerant Report to Fort Hood DPW-ENV, Air Program Office.

### 1.13 WASTE WATER MANAGEMENT

In the waste water management plan, identify the source of wastewater at job site such as sanitary and construction derived waste waters. Address methods and procedures for management and/or discharge of waste waters which are from construction activities such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines (i.e. new main disinfection (or hyper-chlorinated water), concrete wash water, hydrostatic test water, vehicle wash water, etc.).

Wastewater from water main disinfection shall be dechlorinated to less than 4 ppm residual chlorine prior to discharge to the sediment pond or the sanitary sewer system when approved by the Contracting Officer with prior approval and/or notification to the local Waste Water Treatment Plant. A chlorine residual test is required to submit to COR prior to land disposal of wastewater from disinfection of water supply system. . If there are any questions about potential harmful consequences of a specific discharge due to proximity to a sensitive environmental area (e.g., creek, wetlands, etc.) or the volume of the discharge (i.e. wastewater from disinfecting water storage tank), the Contractor shall contact area office Contracting Officer for further guidance. Disinfection of water lines and water storage tank as required in this section requires de-chlorination. Submit the method of dechlorination for approval.

No foreign items, construction debris, chemicals, oils, etc., shall be introduced into the sanitary sewer collection system. Storm water runoff shall be directed away from the sanitary sewer collection system and storm water shall not be disposed into the sanitary collection system.

Wastewater discharge permit is required, except for the following:

- fire fighting activities,
- fire hydrants flushing,

- vehicle wash waters which do not contain detergent or leaked fluids
- minimal dust control runoff to minimize off-site tracking of vehicles,
- potable water from uncontaminated waterline flushing,
- routine external building wash down which does not use detergents and the exterior paint that does not contain mercury, lead, cadmium, and mildewcides,
- pavement wash waters where spills or leaks do not contain hazardous, toxic, radiological material or detergent,
- air conditioning condensate,
- uncontaminated spring or ground water,
- foundation and footing drains which do not contain contaminated process materials such as solvents.

#### 1.14 RECYCLING AND SOLID WASTE MINIMIZATION

Army Assistant Chief of Staff for Installation Management (ACSIM) policy Memorandum - Sustainable Management of Waste in Military Construction, Renovation, and Demolition Activities, mandates that Army military construction, renovation, and demolition projects achieve a minimum of 50 percent diversion of construction and demolition (C&D) waste, by weight, from landfill disposal.

In accordance with Fort Hood Regulation 420-6 (Recycling), all Contractors must participate in the Installation's recycling program

Source Separation Method. Waste products and materials that are recyclable will be separated from trash and debris and sorted into appropriately marked separate containers and then transported to the respective recycling facility. Deliver materials in accordance with recycling or reuse facility requirements (e.g. free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

The Fort Hood Recycle Center is located in Building 4621, at 65th Street and Railhead Drive. The Recycle Center can be reached at 254.287.6372. The Recycle Center is open 0730 - 1600, Monday - Friday.

See paragraph CONDITIONS FOR USE OF FORT HOOD LANDFILL concerning inert material disposal at the Inert Material Management Unit (IMMU) that receives segregated construction and demolition materials such as clean fill, rock, concrete, asphalt payment, sand, sod, clean masonry, and brick.

The Contractor shall contact the Fort Hood Sanitary Landfill concerning wood recycling for trees removed from site clearing and grubbing. The trees may be shredded on-site and the shredded material spread over adjacent vegetative areas for "soil amendments". Do not spread the material to exceed 2.5 inches 63.5 mm in depth, unless otherwise approved by the Contracting Officer. Trees may be loaded and hauled to the Fort Hood Sanitary Landfill (telephone 287-532-2256) where they will be weighed and dumped in the recycle yard for processing.

At Fort Hood range training areas, or areas where erosion rates are known to exceed tolerable limits, the trees identified to be removed shall be cut and shredded on-site and the residue spread

over construction areas for temporary soil stabilization. The shredded material shall be spread to not exceeding 6 inches in depth.

Conserve natural resources during site clearing and grubbing operations. Trees identified to remain shall be preserved in accordance with applicable notes and specifications.

Avoid using organic material for temporary stabilization in areas that are to be paved.

Shredded material used for soil stabilization and erosion control shall be no more than ½-inch diameter and no more than 3-inch in length. Trees to be used for soil amendments and/or as mulch may be shredded and the material stockpiled in an area pre-determined and pre-approved by the Contracting Officer.

A copy of each pre-construction and post construction notification, registrations, certifications, and recycling/reuse waste diversion report with disposal receipts, shall be provided to both the Contracting Officer and the Installation's environmental authorized personnel at project completion with other close-out documents.

#### 1.15 INDOOR RADON PREVENTION

The Contractor shall comply with Indoor Radon Prevention and Mitigation design CODE A - Radon Passive Barrier (see <http://www.hnd.usace.army.mil/techinfo/ti/810-91.pdf>).

CODE A, Radon Passive Barriers shall require the Contractor to provide 6-mil polyethylene sheeting under floor slabs on-grade, a capillary water barrier below floor slabs on-grade, and on the finished grade below the suspended slab. Sealants shall be placed in all joints in floor slabs and around all pipe and conduit penetrations. Joint sealants will be selected and installed according to industry standards. Polyethylene sheets will be lapped and sealed with adhesives or pressure sensitive tape and sealed at foundation walls with mastic. Reference structural foundation detail drawing.

#### 1.16 CERTIFICATION OF NON-ASBESTOS CONTAINING MATERIALS AND PRODUCTS

The construction Contractor shall provide a Certification of Non-Asbestos Containing Materials and Products in construction. A signed statement by a corporate officer, an architect, engineer or State Department of Health Inspector identifying presence or absence of asbestos containing material in all construction building materials. The Contractor shall submit a Certification and Material Safety Data Sheet (MSDS) on each construction material and products (i.e. interior & exterior material of construction including mastic, sealant, roofing felt, roofing coating, non-roofing coating, floor tile and mastic, pipeline wrap, any type of friction material, etc.) and equipment. If MSDS of product or material does not have asbestos containing material data, a state licensed analytical lab shall obtain three bulk samples of from the same material or product for analytical analyses. The MSDS can be kept as a separate binder at the job site. A copy of the MSDS binder shall submit with the Certification at project closeout.

#### 1.17 CERTIFICATION OF NATURAL GAS HEATING EQUIPMENT

- a. The construction Contractor shall provide a Certification of

Natural Gas Heating Equipment. (Note: The Contractor shall comply with the Texas Commission on Environmental Quality (TCEQ) air emission requirement for water heaters, small boilers and process heaters. Submit a document or certificate to verify that the natural gas-fired heating equipment having a maximum rated rating capacity of 2.0 million British Thermal Units per hour (MBtu/hr) or less is in compliance with the Nitrogen Oxide limits as specified in 30 Texas Administrative Code (TAC), Part 1, Chapter 117, Subchapter D, division 1, Rule 117.465.)

b. The construction Contractor shall provide data of HVAC Units and initial HVAC Service and Maintenance Record. It shall include all new HVAC units and related data of each unit (i.e. name of manufacturer, model number, type of refrigerants and amount (in pounds). At least a copy of the log to the Air Program Manager of the new facility on verification of no Ozone Depleting Chemical (ODC) is utilized.

#### 1.18 ENVIRONMENTAL SUSTAINABLE PAINT SYSTEM

The Contractor shall provide statement of proof on environmental sustainable paint system to verify interior and exterior paint systems have met the low volatile organic compounds (VOC) criteria and lead concentration on proposed facilities shall not exceed Consumer Safety Act criteria <http://www.cpsc.gov/businfo/leadguid.html>.

#### 1.19 CONDITIONS FOR USE OF FORT HOOD LANDFILL

Use of the Fort Hood Municipal Solid Waste Landfill, located at the intersection of Turkey Run Road and Clark Road, by the Contractor is subject to the operating requirements imposed on the landfill by the Landfill Operating Permit (TCEQ MSW Permit #1866). All waste delivered to the landfill will be secured and covered and will be inspected by the landfill operating Contractor for materials that are not authorized for disposal in the landfill before entry into the landfill is allowed. Containers that contain unauthorized waste will be diverted for removal of unauthorized material before entry into the landfill. Landfill operating hours are 0730-1700 Monday through Friday and 0730-1400 on Saturday. Questions concerning landfill policy and procedures shall be directed to the landfill at 254-532-2256.

The following classes of materials are NOT authorized in the Fort Hood Municipal Solid Waste Landfill and shall be diverted as described below:

Recyclable Materials: Cardboard and paperboard, light metal, aluminum and steel containers, paper, plastic containers, and serviceable pallets shall be delivered to a recycling center.

Compost Materials: Untreated wood, branches, shrubs, grass, wood chips, unserviceable or odd sized pallets shall be separated from the refuse load and delivered to the Fort Hood Compost Center. The Compost Center is located in the vicinity of the Landfill (corner of Clarke Road and Turkey Run Road). All materials must go through the landfill scales for inspection and weight measurements. Solid Waste Contractor personnel will direct disposition of compost materials. Cedar trees may not be composted and must be delivered to an area designated by the Government for deposition.

Inert Constructions and Demolition Debris: Inert C&D debris includes: clean fill; sand; sod; rock; clean masonry; brick; concrete;



and asphalt. These materials shall be delivered to the Inert Material Management Unit (IMMU) located in the vicinity of the Fort Hood landfill unless otherwise directed by the Contracting Officer.

**Salvageable Items:** Tires, white goods and appliances, bulk scrap metal, certain types of lead-acid batteries, and engine and machine parts shall be delivered to the Defense Reutilization and Marketing Office (DRMO). The DRMO is located in building 4286, located at 80th Street and Tank Destroyer Blvd. The phone number is 254.287.2723. Call for hours of operation and turn-in procedures.

**Serviceable Pallets:** Serviceable pallets are to be delivered to Post Recycling Center Bldg. 4621, located at 65th St. and Railhead Dr., phone 287-6732, Monday-Friday, 0730-1600.)

**Freon:** Freon and other refrigerants shall be collected in designated recovery cylinders/drums (R-123) and separately labeled. Recovered refrigerants will be turned in to DPW-Classification Unit (CU) Building 1346 for processing. Empty containers can be issued to the Contractor for recovery operations if necessary. Each container shall be labeled (i.e. R-12, R-22, etc.) and shall not be mixed. If refrigerants are unintentionally mixed, the Contractor shall properly label the container as "MIXED REFRIGERANTS" and inform the DPW-CU of the suspected mixture. The Contractor shall be responsible for all associated fees and disposal cost. All Freon is received and issued through the DPW-Classification Unit (CU). Contractors are NOT allowed to bring nor authorize the use of Freon from off-post sources. For more information on Freon issue, and/or turn-in call the DPW-CU at 254.287.7627 (SNAP).

**Regulated Waste:** Liquid waste, fluorescent light bulbs, oil filters, ordinance, explosives, pressurized gases, PCB (TCB, DEPH or fluid-typed) ballasts, paints, solvents, antifreeze, pesticides, herbicides, radioactive materials, and biohazardous materials are prohibited from disposal at the Fort Hood landfill. All turn-ins to the DPW Classification Unit are by appointment only. For more information on the management of regulated wastes on Fort Hood, call the DPW-CU at 254.288.7627 (SNAP). The DPW Classification Unit can assist Contractors with containers, packing procedures, waste classifications, and state notifications. The Contractor shall be responsible for all associated fees and disposal cost.

**Asbestos Containing Materials (ACM):** The management of asbestos on Fort Hood requires special procedures mandated by the State of Texas. Contact the Fort Hood Environmental Division prior to the start of work activities for guidance on asbestos waste management. The Contractor shall be responsible for all associated fees and disposal cost..

**Special Wastes:** POL contaminated soil and demolition debris contaminated with lead paint are considered special wastes in the State of Texas. These special wastes require special handling procedures mandated by the State of Texas. Contact the Fort Hood Environmental Division prior to the start of work activities for guidance on special waste management. The Contractor shall be responsible for all associated fees and disposal cost.

**Wastewater from Water Line Disinfection:** Initial and subsequent wastewater discharge from water main or storage tank disinfection (or flushing) shall be dechlorinated to less than 4 ppm residual chlorine

prior to discharge to the sediment pond or the sanitary sewer system when approved by Contracting Officer Representative (COR). There is a large volume of the discharge from disinfecting water storage tank, the Contractor shall contact COR and DPW for further guidance. Dechlorinate superchlorinated wastewater from water line and water storage tank disinfection in accordance with AWWA C651 and AWWA C652. The Contractor is responsible for labor, equipment, all associated fees of for testing, and cost of treatment to meet this requirement.

Verification of water line disinfection shall be performed per AWWA C651. The samples shall be analyzed by an analytical lab that holds the current state license and certification. Repeating disinfection protocols per AWWA C651 are required until satisfactory results are obtained -- that being two consecutive sets of acceptable samples taken 24 hours apart. The water sample analytical results shall be provided to Jack Shackelford of American Water at 254-258-5324 for record-keeping. One water sample at each 1000 linear feet of disinfected water line shall be obtained. Water sample shall be placed in proper sterilized containers and a bacterial examination shall be performed in accordance with state approved methods. The water supply system shall not approve for service until each test result is negative for bacteria examination.

Water Main or Storage Tank Disinfection: The disinfection of new or repaired water mains must be done in accordance with state requirements, currently presented in 30 TAC 290.46(g). Wastewater discharges from water main or storage tank disinfection (or flushing) shall be dechlorinated to less than 4 ppm total chlorine residual prior to discharge to the environment or the sanitary sewer system, and when approved by Contracting Officer Representative (COR). Care must be taken to not cause erosion during the discharge of this wastewater. In addition, water with any detectable total chlorine residual may not be discharged in such a manner that it enters any surface water body. The dechlorination of superchlorinated water shall be done in accordance with current AWWA guidance. The Contractor is responsible for all labor, equipment, and costs or fees associated with the testing, treatment or disposal of wastewater to meet this requirement.

The sample results must indicate that the water main or storage tank is free of microbiological contamination before it is placed into service..

A

copy of the bacteriological sample results shall be provided to the water distribution system operator (currently DPW). The current DPW POC may be contacted at 254-287-4256/6499.

#### 1.19.1 Landfill Permit

Contractor shall complete the attached Landfill Permit and give copies, laminated or inserted in page protectors, to drivers so that the drivers could leave them in their trucks. Drivers can just hand the permit to the scale operator at the landfill rather than having to remember all information.

#### 1.20 SOLID WASTE AND CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

The Contractor shall transport solid waste which is not permitted in the

Fort Hood Municipal Landfill off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill shall be the minimum acceptable off-site solid waste disposal option. The Contractor shall verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. Waste materials shall be hauled to the Government landfill site shown on the drawings. Authorized waste materials may be hauled to the Fort Hood Sanitary landfill site shown on the drawings or designated by the Contracting Officer; see paragraph CONDITIONS FOR USE OF FORT HOOD LANDFILL, this Section.

#### 1.20.1 Fuel and Lubricants

If fuel storage tank is permitted on site by the Contracting Officer, storage, fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants and oil shall be managed and stored in accordance with all Federal, State, Regional, and local laws and regulations. A layout and elevation view or detail of the fuel storage tank and fueling area shall be submitted to the COR for review and approval. Used lubricants and used oil to be discarded shall be stored in marked corrosion-resistant containers and recycled or disposed in accordance with 40 CFR 279, State, and local laws and regulations. Storage of fuel on the project site shall be accordance with all Federal, State, and local laws and regulations. The storage tank shall meet the double-walled containment requirement per Texas Administrative Code, Title 30, Chapter 334, Underground and Aboveground Storage Tank, Subchapter F, Aboveground Storage Tank, and 40 CFR 112, DA AR 200-1 and Fort Hood Regulations 200-1 and 200-10.

#### 1.21 CUSTOMER SERVICE INSPECTIONS

##### 1.21.1 Certification Requirements

A Customer Service Inspection and Certification must be performed in accordance with the Texas Administrative Code, Title 30, Part 1, Chapter 290, Subchapter D, Rule 290.46 before providing continuous water service to new construction; on any existing service when the water purveyor has reason to believe that cross-connections or other potential contaminant hazards exist; or after any material improvement, correction, or addition to the private water distribution facilities.

##### 1.21.2 Inspection

The Customer Inspection certifies that all performed work meets the requirements of the Texas Administrative Code, Title 30, Part 1, Chapter 290, Subchapter D, Rule 290.46.

##### 1.21.3 Inspection Personnel

Customer Service Inspections must be performed by personnel meeting the requirements described in the Texas Administrative Code, Title 30, Part 1, Chapter 290, Subchapter D, Rule 290.46.

##### 1.21.4 Inspection Certification Form

Original copies of the Customer Service Inspection Certification shall be provided to the Contracting Officer's Representative prior to final inspection and acceptance. Certification forms will be maintained by

the Fort Hood DPW Water and Wastewater Utility representative. A sample form is provided at the end of this section. The form submitted shall meet all provisions of Rule 290.46. The form (appendix D) can also be downloaded from the TNRCC's home page at the web site:

[http://info.sos.state.tx.us/fids/30\\_0290\\_0047-22.html](http://info.sos.state.tx.us/fids/30_0290_0047-22.html).

#### 1.22 Appendix F Sample Backflow Prevention Assembly Test & Maint. Report

The certificate "Appendix F. Sample Backflow Prevention Assembly Test and Maintenance Report" is attached at the end of this section.

#### 1.23 PROCEDURE FOR RECEIPT OF MECHANICAL KEYS FROM CONTRACTORS (MAY 2005)

The attachment is located at the end of the section.

##### 1.23.1 Keyway

For all projects, the keyway will be a single bitted, 5 disc keyway based on the Fort Lock KS00V key blank key coded to CAT 15.

#### 1.24 CONSTRUCTION MATERIALS TESTING FREQUENCIES

The attachment is located at the end of the section.

#### 1.25 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all areas used for construction in accordance with Contract Clause: "Cleaning Up". The Contractor shall, unless otherwise instructed in writing by the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed area shall be graded, filled and the entire area seeded unless otherwise indicated.

Excavation, filling, and plowing of roadways will be required to restore the area to near normal conditions and permit the growth of vegetation thereon. The disturbed areas shall be graded and filled. Sufficient topsoil shall be spread to - provide a minimum depth of 100-mm (4 inches) of suitable soil for the growth of grass. The entire area seeded, and a uniform perennial vegetative cover with a density of 70 percent established. Restoration to original contours is not required.

#### PART 2 PRODUCTS (NOT APPLICABLE)

#### PART 3 EXECUTION

Family Life Center, PN 71515, Fort Hood, Texas

3.1 FORMS

3.1.1 Landfill Permit

LANDFILL PERMIT  
US ARMY Corps of Engineers

COE POC and telephone phone number:

---

Contract Name:

---

Contract Number:

---

Contract completion date or end of authorization date:

---

Building or areas affected (i.e., Soldier's Development Center):

---

---

---

Prime Contractor's Name:

---

Contractor POC and phone (i.e. someone on site that can get immediate action):

---

FH10

## 2

# Customer Service Inspection Certificate

### Location of Service

	Compliance	Non-Compliance
(1) No direct connection between the public drinking water supply and a potential source of contamination exists. Potential sources of contamination are isolated from the public water system by an air gap or an appropriate backflow prevention assembly in accordance with Commission regulations.	[ ]	[ ]
(2) No cross-connection between the public drinking water supply and a private water system exists. Where an actual air gap is not maintained between the public water supply and a private water supply, an approved reduced pressure-zone backflow prevention assembly is properly installed and a service agreement exists for annual inspection and testing by a certified backflow prevention assembly tester.	[ ]	[ ]
(3) No connection exists which would allow the return of water used for condensing, cooling or industrial processes back to the public water supply.	[ ]	[ ]
(4) No pipe or pipe fitting which contains more than 8.0% lead exists in private water distribution facilities installed on or after July 1, 1988.	[ ]	[ ]
(5) No solder or flux which contains more than 0.2% lead exists in private water distribution facilities installed on or after July 1, 1988.	[ ]	[ ]

Family Life Center, PN 71515, Fort Hood, Texas

FH10

I further certify that the following materials were used in the installation of the private water distribution facilities:

[http://info.sos.state.tx.us/fids/30\\_0290\\_0047-22.html](http://info.sos.state.tx.us/fids/30_0290_0047-22.html)

Family Life Center, PN 71515, Fort Hood, Texas

FH10

Figure: 30 TAC §290.47(d)  
2

Page 2 of

Service lines    Lead [ ]        Copper [ ]                    PVC [ ] Other [ ]  
Solder            Lead [ ]    Lead Free [ ]    Solvent Weld [ ] Other [ ]

I recognize that this document shall become a permanent record of the  
aforementioned Public Water System and that I am legally responsible for  
the validity of the information I have provided.

Remarks:

---

---

Signature of Inspector

Registration Number

---

Title

Type of Registration

---

Date[http://info.sos.state.tx.us/fids/30\\_0290\\_0047-22.html](http://info.sos.state.tx.us/fids/30_0290_0047-22.html)



Family Life Center, PN 71515, Fort Hood, Texas

3.1.3 AFCM Certification Letter

Asbestos Free Construction Material  
Certification Letter

Project Name: \_\_\_\_\_

Name of Contractor: \_\_\_\_\_

Project Delivery Order Number: \_\_\_\_\_

Facility Number: \_\_\_\_\_

Date: \_\_\_\_\_

To Whom It May Concern:

This letter is to certify that the project indicated above has been constructed using no asbestos containing materials in accordance with the design requirements.

Sincerely,

Typed Name: \_\_\_\_\_

Written / Typed Name \_\_\_\_\_

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**STANDING OPERATING  
PROCEDURE**  
No. MNT 02-04

**Directorate of Public Works**  
III Corps and Fort Hood, TX  
Fort Hood, TX 76544-5028

**PROCEDURE FOR RECEIPT OF MECHANICAL KEYS FROM CONTRACTORS**

**~ MAY 2005 ~**

1. **PURPOSE:** To outline the procedure to perform all contracting and credit card purchases for installation of locking devices or duplicating key requirements.
2. **OBJECTIVE:** To provide a simplified procedure to facilitate lock and key control at Fort Hood.
3. **APPLICABILITY:** This Standard Operating Procedure (SOP) is applicable to Contractors, Contracting Officer Representatives (COR) and Corps of Engineer personnel. The SOP applies to all types of locks/keys used on Fort Hood Real Property facilities except for "card reader" (plastic) type locks and keys. Card reader and cardkey operations are covered under separate SOP.
4. **RESPONSIBILITIES**
  - A. Existing Facilities
    - (1) Contractors. Directorate of Public Works (DPW) and Corps of Engineer personnel will provide keys that match the key codes and hardware in all existing facilities where locking mechanisms are being installed or replaced.
    - (2) For contract orders that do not require total replacement of the locking system for a facility, the appropriate facility key codes will be obtained from the DPW Lock Shop located in building 4208. The purpose of this requirement is to ensure that new or replacement keys are compatible with the respective existing building key system(s).
    - (3) There will be five keys provided consisting of four facility manager keys and one key to be used as a board key by the DPW Lock Shop. The keys will be marked as specified in paragraph 5 below.
    - (4) The contractor will provide an updated key schedule and building floor plan through the Contracting Officer Representative (COE) or Corps of Engineers representative to the Real Property office located in building 4612 before an action can be completed for payment for completion of contract and/or services. The floor plan will be in one-half print size drawing or larger. Key designations will be legible to the eye.

**STANDING OPERATING  
PROCEDURE**  
No. MNT 02-04

**Directorate of Public Works**  
III Corps and Fort Hood, TX  
Fort Hood, TX 76544-5028

- (5) Mechanical/electrical/utility rooms are keyed with a 3-1 keyed core. The Lock Shop will provide 3-1 keys to the contract COR for the use by the contractor until contract completion.

If the project contract adds one or more mechanical/electrical/utility rooms to the building(s), the contractor will provide required L keyway blank cores to the project COR. The COR will provide the blank cores to the Lock Shop and submit a service order request to Work Services for the Lock Shop to have the new cores pinned to 3-1 keys. The COR will insure that all 3-1 locks are installed and working properly.

**B. New Facilities.**

- (1) Contractors, DPW and Corps of Engineer personnel will provide keys, key schedules, key codes, hardware list and floor plans for all facilities where locking mechanisms are being installed. This will occur no later than 30 days prior to turn over of facility to DPW. If the 30 days suspense cannot be met the COR will negotiate a new suspense with Real Property.

- (2) Locks will be keyed in sets or subsets as scheduled by contract specifications. The following types and amounts of keys will be provided:

(a) Five change keys per lock set provided for each room door and each entry and/or exit door in the facility. The five keys will consist of four facility manager keys (in one envelope or on one key ring) for Real Property and one key (in one envelope or on one key ring) to be used as a board key by the DPW Lock Shop.

(b) Twelve master keyed sets (master, grandmaster and/or great grandmaster key(s) as appropriate for use by the DPW Lock Shop and by Emergency Services (Fire Department).

(c) Six control/core keys will be provided by for use by the DPW Lock Shop.

(d) The keys will be marked as specified in paragraph 5 below.

- (3) The contractor will maintain secure control of all keys until turned over to Real Property.

(4) Keys, key schedules, key codes, hardware list and floor plans will be provided through the COR to Real Property located in building 4612 before any action can be completed for Final payment.

(5) The keys are to be provided to Real Property the day of final inspection and acceptance of the new facility.

**APPENDIX P****STANDING OPERATING  
PROCEDURE**

No. MNT 02-04

**Directorate of Public Works**

III Corps and Fort Hood, TX

Fort Hood, TX 76544-5028

(6) The Project COR will be responsible for turning in all keys, key schedules, biting codes, and facility floor plans as referenced in paragraph 4.B.(1) above to DPW Real Property. This must occur before final payment is made to the Contractor.

(7) Locks shall be Grade #1 with 7 pin interchangeable cores (IC) Falcon brand or equal.

**5. KEY MARKING:**

A. "US GOVERNMENT/DO NOT DUPLICATE" will be marked on keys provided.

B. The four Facility Manager keys will be marked with the building code and room number. (See enclosure 1).

C. The DPW Lock Shop board key will be marked with the facility number and room number. The board key will not be marked with the code of the facility/building. (See enclosure 2).

D. The 12 Master keys will be marked with building number, building code and an "M" (Master), "GM" (Grandmaster) or "GGM" (Great Grandmaster) as applicable.

E. The six core keys will be marked with building number, building code, and a "C".

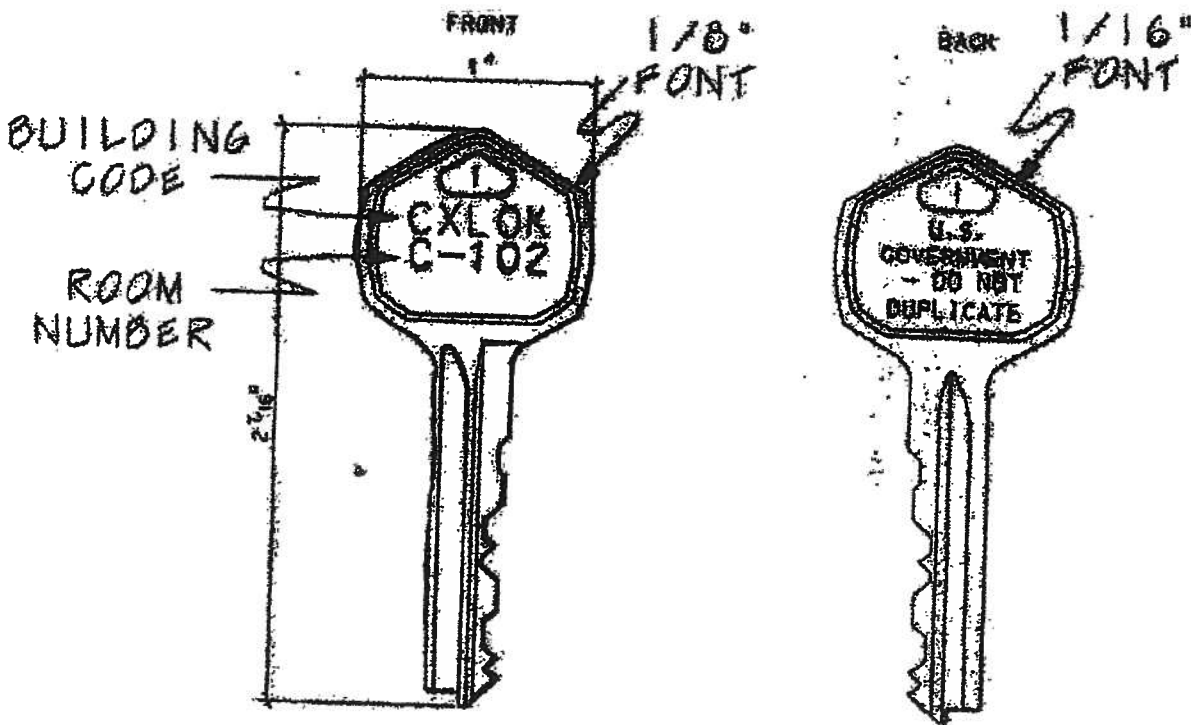
F. Key markings will be between 1/16 inch and 1/8 inch and be legible to the eye.

Encls

**RODERICK A. CHISOLM**  
Director of Public Works

CF:

All DPW Divisions



**CHANGE KEY**  
FOUR EACH PER LOCK

## Construction Materials Testing Frequencies

### Soils:

- Building Pads-----1 test per 2000 square feet for subgrade and select/non-expansive fill using other than hand operated equipment
- 1 test per 500 square feet for subgrade and select/nom-expansive fill using hand operated equipment
- Moisture density curve, atterberg limits and classification for each different material
- When using nuclear density gauges to determine density, check tests (sand cone) will be taken for the first five tests and every fifth test thereafter.
- 6 inch compacted tests.....92% compaction (ASTM 1557 Method C)
- Non-expansive fill: THD Item 247 Type A Grade 1 or 2 (PI < 12)
- Select Fill: Liquid limit < 35 and PI < 20

### General cut and fill areas:

- 1 test per 2000 square yards for raw subgrade using other than hand operated equipment
- 1 test per 500 square yards using hand operated equipment
- 1 test per 100 linear feet in all roadways
- Moisture density curve, atterberg limits and classification for each different material
- 6 inch compacted lifts-----90% compaction (ASTM C1557 Method C)
- 1 test per 6 inch compacted lift on each manhole, inlet or other walls and structures
- When using nuclear density guages, check tests (sand cone) will be taken for the 1<sup>st</sup> 5 tests and every fifth test thereafter.

### Lime Stabilized Subgrade

- Rate of application if PI < 25-----4%
- PI >25<40---5%
- PI>40-----6%

## Lime (Cont)

- 6 inch compacted lifts
- 95% compaction of ASTM C 1557 (Method C)
- density test—one test per 500 square yards
- Sand cones (one for one until correlation is approved)
- Thickness tests—one test per 500 square yards
- Lime to be applied in slurry ONLY
- Gradation of pulverized material shall be 60% passing the #4 sieve excluding rock
- Lime products shall have 99.5% passing the #20 sieve and 85% passing the #100 sieve
- in place stabilized materials materials will be curing for 7 days with bituminous materials (MC-30)

- Subbase----
- 1 density test per 1000 square yards for each 6 inch compacted lift
  - THD Item 247 Type A Grade I or 2
  - Wear test < 50% loss
  - Sieve analysis—1 test per each day material delivered
  - In place sieve analysis and wear test ( 1 test per 3000 square yards)completed base
  - Check tests (sand cone) for 1<sup>st</sup> five test and every fifth test thereafter

## Aggregate base Course:

- One density test per 500 square yards for each 6 inch compacted lift
- Item 247 Type A Grade I
- Wear test < 50%
- 1 sieve analysis each day material is delivered
- 1 sieve analysis and wear test per 3000 square yards of completed base
- Check test (sand cone) for 1<sup>st</sup> 5 tests and every 5<sup>th</sup> test thereafter

## Utilities:

- Initial backfill for bedding and extending a minimum of 1 foot above the pipe shall conform to ASTM D 448 size #6 stone



- Final density---1 density test per 100 linear feet for each 6 inch compacted lift in roads, paved and traffic areas
- 1 density test per 300 linear feet for each 12 inch compacted lift  
In grassed and turfed areas

**\*\* All testing technicians shall be NICET Level 1 Soils certified.**

#### Concrete:

**\*\* All testing technicians shall be ACI Level I concrete field testing certified**

#### Slumps:

- Piers-----5 to 7 inch
- Grade beams--- 2-4 inch
- Slabs ----- 1-3 inch
- Curb and gutter/ Sidewalks –1-3 inch
- \*\* Pumped concrete---6 inch slump**

All exposed concrete shall have air contents between 3-5%

Maximum concrete temperature--- 85 degrees unless retarder is used—then 90degrees

#### Strengths:

- Piers/slabs/grade beams -----3000psi
- Slabs subject to vehicular traffic----650 psi flexural strength
- Curb & gutter? Sidewalks-----3500 psi
- Miscellaneous structures-----3000 psi

Strength testing-----one test per 150 cubic yards or every 5000 square feet, whichever is greater

Aggregate testing –one test per week on both coarse and fine aggregate

#### Asphalt:

Mix gradation shall conform to THD Item 341 Type D.

Marshall method (ASTM D 1559) 50 blow shall be used for specimens

- Stability –500 ( if high stability areas then 1800)
- Flow < 16

-----% voids 3-5%

-----% void filled 75-85%

The mixture shall be tested once every 200 hundred tons for:

-----gradation ( extraction test ----mechanical or ignition oven allowed)

-----lab density, flow, stability

-----maximum theoretical density

Field density test shall be tested using drilled cores. Three cores per 200 tons ( two mats and one joint). Cores will be used fro thickness tests also.

Density requirements---Mat density 97% of lab compacted density

---Joint density 95% of lab compacted density

Masonry:

Mortar test---one test per day (ASTM C 780)---1800 psi

Grout test----one test per day (ASTM C 39 )----2000 psi

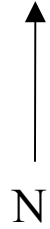
----9-11 inch slump

## Section:

- 
- 
- 

[illegible]

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## LANDFILL

Special Waste such as dead animals, regulated and non-regulated asbestos containing material, lead-based paint are accepted with manifest from DPW Classification Unit.  
All Municipal Solid Waste

SCALE

NEW DIRT ROAD

M-F 0730-1630; Sat 0730-1330.  
Loads must be tarped and completely contained in the vehicle to obtain entrance into the landfill. Contractor must have Contract # and Bldg # to provide to the scale operator.

GO TO SCALE 1<sup>ST</sup>

## IMMU

SOIL, SAND, ROCK,  
CLEAN MASONRY,  
BRICK, CONCRETE  
(NO PROTRUDING  
REBAR), ASPHALT

**SEE BACK  
OF SHEET**

TURKEY RUN ROAD

TANK DESTROYER BLVD

GO TO SCALE 1<sup>ST</sup>

## HARD WOOD

CEDAR, OAK, OTHER  
TREES. MUST BE  
SEPARATED. TREES  
MUST BE CUT 8' OR  
SHORTER. NO ROOT  
BALLS.

CLARKE ROAD

WFH  
GATE

GO TO SCALE 1<sup>ST</sup>  
**COMPOST**

YARD WASTE, TRIMMINGS,  
MANURE, LIMBS, LEAVES,  
SHRUBS, UNTREATED LUMBER.  
LUMBER MUST BE CUT 8' OR  
SHORTER. NO METAL PIECES  
EXCEPT FOR SMALL NAILS AND  
SCREWS.

FORT HOOD RECYCLE CENTER  
BLDG #4621. Located at 65<sup>th</sup> and  
Railhead Dr., 287-6732. M-F 0730-1600  
Center accepts cardboard, paper, metal,  
useable pallets. **NOT SHOWN.**

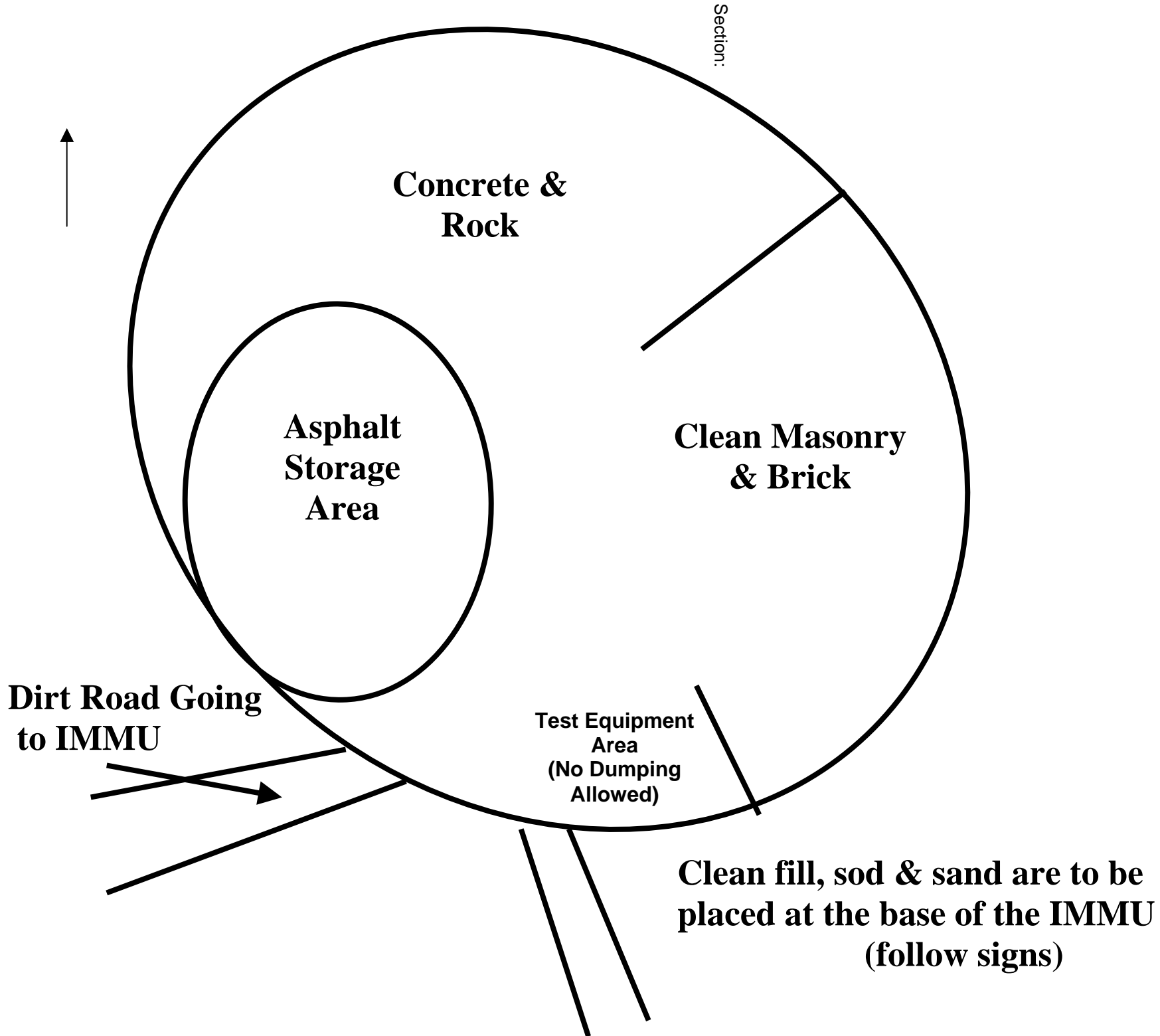
DRMO: BLDG # 4286. Located at  
80<sup>th</sup> and Tank Destroyer, 287-2723.  
M-TH 0730-1300. DRMO accepts tires,  
white goods, lead acid batteries and  
engine and machine parts. Appointment  
only facility. **NOT SHOWN.**

DPW CLASSIFICATION UNIT:  
BLDG #1345. Located at 37<sup>th</sup> and  
North Ave, 288-7627. M-TH  
0730-1630 Unit accepts regulated  
wastes such as liquids, florescent  
light bulbs, paints, solvents and oil  
filters. Appointment only facility.  
**NOT SHOWN.**

CLEAR CREEK

79<sup>TH</sup> STREET

79TH  
GATE



## Proposed Project Emissions Inventory Questionnaire for New Sources

Indicate proposed source type and complete required information.  
Complete separate questionnaire sheet for each proposed project.

Requestor: \_\_\_\_\_ Date: \_\_\_\_\_ Phone: \_\_\_\_\_  
Project # \_\_\_\_\_  
Facility Name / Building Number: \_\_\_\_\_  
Descriptive Name of Facility: \_\_\_\_\_  
Location of Facility: UTM Zone: 14 Horizontal Coordinate \_\_\_\_\_ E  
Vertical Coordinate \_\_\_\_\_ N

**ENV Use Only**

Received on \_\_\_\_\_ for submittal in \_\_\_\_\_ Permit

### AUTHORIZATION TO PROCEED WITH CHANGE

Authorized by: \_\_\_\_\_ Title: \_\_\_\_\_  
Signature: \_\_\_\_\_ Date: \_\_\_\_\_

### AUTHORIZATION FOR STARTUP

Authorized by: \_\_\_\_\_ Title: \_\_\_\_\_

### DEGREASERS (Covered by [30 Texas Administrative Code \(TAC\) 106.454](#))

- Attach MSDS of proposed degreaser solvent
- Degreaser Type: Parts Cleaner / Paint Gun Cleaner (circle one)
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_ hours/day \_\_\_\_\_ days/week \_\_\_\_\_ weeks/year \_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_ gallons/year

### DEGREASERS

- Attach MSDS of proposed degreaser solvent
- Degreaser Type: Parts Cleaner / Paint Gun Cleaner (circle one)
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_ hours/day \_\_\_\_\_ days/week \_\_\_\_\_ weeks/year \_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_ gallons/year

### DEGREASERS

- Attach MSDS of proposed degreaser solvent
- Degreaser Type: Parts Cleaner / Paint Gun Cleaner (circle one)
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_ hours/day \_\_\_\_\_ days/week \_\_\_\_\_ weeks/year \_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_ gallons/year

## Proposed Project Emissions Inventory Questionnaire for New Sources (p.2)

### INTERNAL COMBUSTION UNITS (I.E. GENERATORS, ENGINE TEST CELLS)

(Covered by [30 TAC 106.511](#) and [30 TAC 106.261](#))

- Power Rating: \_\_\_\_\_ kw
- Engine Horsepower: \_\_\_\_\_
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- Fuel Type: MUR / Diesel / JP8 / Natural Gas / Propane / Other \_\_\_\_\_ (circle one)
- Integrated Fuel Tank Capacity: \_\_\_\_\_ gallons
- Associated Fuel Tank(s): YES / NO (circle one) Complete Separate Questionnaire for Each Tank
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_ hours/day \_\_\_\_\_ days/week \_\_\_\_\_ weeks/year \_\_\_\_\_

### INTERNAL COMBUSTION UNITS (I.E. GENERATORS, ENGINE TEST CELLS)

- Power Rating: \_\_\_\_\_ kw
- Engine Horsepower: \_\_\_\_\_
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- Fuel Type: MUR / Diesel / JP8 / Natural Gas / Propane / Other \_\_\_\_\_ (circle one)
- Integrated Fuel Tank Capacity: \_\_\_\_\_ gallons
- Associated Fuel Tank(s): YES / NO (circle one) Complete Separate Questionnaire for Each Tank
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_ hours/day \_\_\_\_\_ days/week \_\_\_\_\_ weeks/year \_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_ gallons or CuFt/ year

### INTERNAL COMBUSTION UNITS (I.E. GENERATORS, ENGINE TEST CELLS)

- Power Rating: \_\_\_\_\_ kw
- Engine Horsepower: \_\_\_\_\_
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- Fuel Type: MUR / Diesel / JP8 / Natural Gas / Propane / Other \_\_\_\_\_ (circle one)
- Integrated Fuel Tank Capacity: \_\_\_\_\_ gallons
- Associated Fuel Tank(s): YES / NO (circle one) Complete Separate Questionnaire for Each Tank
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_ hours/day \_\_\_\_\_ days/week \_\_\_\_\_ weeks/year \_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_ gallons or CuFt/ year



## Proposed Project Emissions Inventory Questionnaire for New Sources (p.3)

### REFRIGERATION EQUIPMENT (I.E. AIR CONDITIONING SYSTEM, FREEZER)

(Covered by [30 TAC 106.103](#))

- Power Rating: \_\_\_\_\_kw
- Unit Type: Chiller / Direct Expansion / Geothermal / Other \_\_\_\_\_
- Number of compressors: \_\_\_\_\_
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- Refrigerant Type: R-22 / R-134a / R-404 / Other \_\_\_\_\_ (circle one or write in)
- Amount of Charge: \_\_\_\_\_ lbs; Initial Charge Date: \_\_\_\_/\_\_\_\_/\_\_\_\_
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_% Summer \_\_\_\_% Fall \_\_\_\_% Winter \_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year \_\_\_\_\_

### REFRIGERATION EQUIPMENT (I.E. AIR CONDITIONING SYSTEM, FREEZER)

- Power Rating: \_\_\_\_\_kw
- Unit Type: Chiller / Direct Expansion / Geothermal / Other \_\_\_\_\_
- Number of compressors: \_\_\_\_\_
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- Refrigerant Type: R-22 / R-134a / R-404 / Other \_\_\_\_\_ (circle one or write in)
- Amount of Charge: \_\_\_\_\_ lbs; Initial Charge Date: \_\_\_\_/\_\_\_\_/\_\_\_\_
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_% Summer \_\_\_\_% Fall \_\_\_\_% Winter \_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year \_\_\_\_\_

### REFRIGERATION EQUIPMENT (I.E. AIR CONDITIONING SYSTEM, FREEZER)

- Power Rating: \_\_\_\_\_kw
- Unit Type: Chiller / Direct Expansion / Geothermal / Other \_\_\_\_\_
- Number of compressors: \_\_\_\_\_
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- Refrigerant Type: R-22 / R-134a / R-404 / Other \_\_\_\_\_ (circle one or write in)
- Amount of Charge: \_\_\_\_\_ lbs; Initial Charge Date: \_\_\_\_/\_\_\_\_/\_\_\_\_
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_% Summer \_\_\_\_% Fall \_\_\_\_% Winter \_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year \_\_\_\_\_

## Proposed Project Emissions Inventory Questionnaire for New Sources (p.4)

### FUEL STORAGE TANKS

(Covered by [30 TAC 115.473](#) , [30 TAC 106.478](#) and [30 TAC Chap 115](#))

- Fuel Type: MUR / Diesel / JP-8 / Propane / Other \_\_\_\_\_ (circle one)
- Tank Type: Aboveground / Underground (circle one)
- Vapor Control Equipped: YES / NO (circle one)
- Tank Volume: \_\_\_\_\_gallons
- Tank Dimensions: Dia \_\_\_\_\_Length\_\_\_\_\_Height\_\_\_\_\_ Color: \_\_\_\_\_
- Tank Type: Horizontal Fixed Roof / Vertical Fixed Roof / Internal Floating Roof / Pressure Tank  
External Floating Roof / Underground Tank
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time\_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year\_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_gallons/year
- Maximum Operating Rate: \_\_\_\_\_gallons/hour

### FUEL STORAGE TANKS

- Fuel Type: MUR / Diesel / JP-8 / Propane / Other \_\_\_\_\_ (circle one)
- Tank Type: Aboveground / Underground (circle one)
- Vapor Control Equipped: YES / NO (circle one)
- Tank Volume: \_\_\_\_\_gallons
- Tank Dimensions: Dia \_\_\_\_\_Length\_\_\_\_\_Height\_\_\_\_\_ Color: \_\_\_\_\_
- Tank Type: Horizontal Fixed Roof / Vertical Fixed Roof / Internal Floating Roof / Pressure Tank  
External Floating Roof / Underground Tank
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time\_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year\_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_gallons/year
- Maximum Operating Rate: \_\_\_\_\_gallons/hour

### FUEL STORAGE TANKS

- Fuel Type: MUR / Diesel / JP-8 / Propane / Other \_\_\_\_\_ (circle one)
- Tank Type: Aboveground / Underground (circle one)
- Vapor Control Equipped: YES / NO (circle one)
- Tank Volume: \_\_\_\_\_gallons
- Tank Dimensions: Dia \_\_\_\_\_Length\_\_\_\_\_Height\_\_\_\_\_ Color: \_\_\_\_\_
- Tank Type: Horizontal Fixed Roof / Vertical Fixed Roof / Internal Floating Roof / Pressure Tank  
External Floating Roof / Underground Tank
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time\_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year\_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_gallons/year
- Maximum Operating Rate: \_\_\_\_\_gallons/hour

## Proposed Project Emissions Inventory Questionnaire for New Sources (p.5)

### FUEL DISPENSING UNITS (Covered by [30 TAC 106.412](#))

- Fuel Type: MUR / Diesel / JP-8 / Other \_\_\_\_\_ (circle one)
- Dispensing Type: Retail / Bulk (circle one)
- Vapor Control Equipped : YES / NO (circle one)
- Dispenser Pump Capacity: \_\_\_\_\_ gallons/minute
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year\_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_gallons/year

### FUEL DISPENSING UNITS

- Fuel Type: MUR / Diesel / JP-8 / Other \_\_\_\_\_ (circle one)
- Dispensing Type: Retail / Bulk (circle one)
- Vapor Control Equipped : YES / NO (circle one)
- Dispenser Pump Capacity: \_\_\_\_\_ gallons/minute
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year\_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_gallons/year

### FUEL DISPENSING UNITS

- Fuel Type: MUR / Diesel / JP-8 / Other \_\_\_\_\_ (circle one)
- Dispensing Type: Retail / Bulk (circle one)
- Vapor Control Equipped : YES / NO (circle one)
- Dispenser Pump Capacity: \_\_\_\_\_ gallons/minute
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year\_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_gallons/year

### FUEL DISPENSING UNITS

- Fuel Type: MUR / Diesel / JP-8 / Other \_\_\_\_\_ (circle one)
- Dispensing Type: Retail / Bulk (circle one)
- Vapor Control Equipped : YES / NO (circle one)
- Dispenser Pump Capacity: \_\_\_\_\_ gallons/minute
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year\_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_gallons/year

## Proposed Project Emissions Inventory Questionnaire for New Sources (p.6)

### WELDING OPERATIONS (Covered by [30 TAC 106.227](#))

- Attach approved MSDS of each welding rod type used in process
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- Particulate Matter Control Efficiency of hood (if available): \_\_\_\_\_ %
- Exhaust Fan Ventilation Rate : \_\_\_\_\_ scfm
- Acetylene on hand: \_\_\_\_\_ lbs of gas
- Oxygen on hand: \_\_\_\_\_ lbs of gas
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_ % Summer \_\_\_\_\_ % Fall \_\_\_\_\_ % Winter \_\_\_\_\_ % **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_ hours/day \_\_\_\_\_ days/week \_\_\_\_\_ weeks/year \_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_ # of rods/year

### WELDING OPERATIONS

- Attach approved MSDS of each welding rod type used in process
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- Particulate Matter Control Efficiency of hood (if available): \_\_\_\_\_ %
- Exhaust Fan Ventilation Rate : \_\_\_\_\_ scfm
- Acetylene on hand: \_\_\_\_\_ lbs of gas
- Oxygen on hand: \_\_\_\_\_ lbs of gas
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_ % Summer \_\_\_\_\_ % Fall \_\_\_\_\_ % Winter \_\_\_\_\_ % **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_ hours/day \_\_\_\_\_ days/week \_\_\_\_\_ weeks/year \_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_ # of rods/year

### WELDING OPERATIONS

- Attach approved MSDS of each welding rod type used in process
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- Particulate Matter Control Efficiency of hood (if available): \_\_\_\_\_ %
- Exhaust Fan Ventilation Rate : \_\_\_\_\_ scfm
- Acetylene on hand: \_\_\_\_\_ lbs of gas
- Oxygen on hand: \_\_\_\_\_ lbs of gas
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_ % Summer \_\_\_\_\_ % Fall \_\_\_\_\_ % Winter \_\_\_\_\_ % **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_ hours/day \_\_\_\_\_ days/week \_\_\_\_\_ weeks/year \_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_ # of rods/year

## Proposed Project Emissions Inventory Questionnaire for New Sources (p.7)

### EXTERNAL COMBUSTION UNITS (Boilers, Hotwater Heaters, Process Heaters)

(Covered by [30 TAC 106.102](#) and [30 TAC 106.183](#))

- Fuel Type: Natural Gas / Boiler Fuel / Diesel (circle one)
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- MMBTU Input Rating of Equipment: \_\_\_\_\_
- Height of Stack: \_\_\_\_\_ Diameter of Stack: \_\_\_\_\_
- Stack Exhaust Velocity: \_\_\_\_\_ ft / sec
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year\_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_gallons/year

### EXTERNAL COMBUSTION UNITS (Boilers, Hotwater Heaters, Process Heaters)

- Fuel Type: Natural Gas / Boiler Fuel / Diesel (circle one)
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- MMBTU Input Rating of Equipment: \_\_\_\_\_
- Height of Stack: \_\_\_\_\_ Diameter of Stack: \_\_\_\_\_
- Stack Exhaust Velocity: \_\_\_\_\_ ft / sec
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year\_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_gallons/year

### EXTERNAL COMBUSTION UNITS (Boilers, Hotwater Heaters, Process Heaters)

- Fuel Type: Natural Gas / Boiler Fuel / Diesel (circle one)
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- MMBTU Input Rating of Equipment: \_\_\_\_\_
- Height of Stack: \_\_\_\_\_ Diameter of Stack: \_\_\_\_\_
- Stack Exhaust Velocity: \_\_\_\_\_ ft / sec
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year\_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_gallons/year

## Proposed Project Emissions Inventory Questionnaire for New Sources (p.8)

### **SURFACE COATING OPERATIONS** (Covered by [30 TAC 106.433](#) , [30 TAC 106.436](#) or [30 TAC 116.110](#))

- Attach approved MSDS of each coating and solvent used in process
- Particulate Matter Control Efficiency of Booth: \_\_\_\_\_%
- Booth Air Flow Rate: \_\_\_\_\_scfm
- Transfer Efficiency of Paint Gun: \_\_\_\_\_%
- Number of Paint Guns: \_\_\_\_\_
- Associated Heater: YES / NO (circle one) Complete Separate Questionnaire for Each Heater
- Associated Gun Cleaner: YES / NO (circle one) Complete Separate Questionnaire for Each Cleaner
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year \_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_gallons/year (each coating and solvent)

### **SURFACE COATING OPERATIONS**

- Attach approved MSDS of each coating and solvent used in process
- Particulate Matter Control Efficiency of Booth: \_\_\_\_\_%
- Booth Air Flow Rate: \_\_\_\_\_scfm
- Transfer Efficiency of Paint Gun: \_\_\_\_\_%
- Number of Paint Guns: \_\_\_\_\_
- Associated Heater: YES / NO (circle one) Complete Separate Questionnaire for Each Heater
- Associated Gun Cleaner: YES / NO (circle one) Complete Separate Questionnaire for Each Cleaner
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year \_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_gallons/year (each coating and solvent)

### **SURFACE COATING OPERATIONS**

- Attach approved MSDS of each coating and solvent used in process
- Particulate Matter Control Efficiency of Booth: \_\_\_\_\_%
- Booth Air Flow Rate: \_\_\_\_\_scfm
- Transfer Efficiency of Paint Gun: \_\_\_\_\_%
- Number of Paint Guns: \_\_\_\_\_
- Associated Heater: YES / NO (circle one) Complete Separate Questionnaire for Each Heater
- Associated Gun Cleaner: YES / NO (circle one) Complete Separate Questionnaire for Each Cleaner
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year \_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_gallons/year (each coating and solvent)

## Proposed Project Emissions Inventory Questionnaire for New Sources (p.9)

### BRAKE REPAIR OPERATIONS (Covered by [30 TAC 106.261](#) and [30 TAC 106.262](#))

- Attach approved MSDS of each welding rod type used in process
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- Particulate Matter Control Efficiency of hood (if available): 1<sup>st</sup> Stage \_\_\_\_\_%; 2<sup>nd</sup> Stage \_\_\_\_\_%
- Exhaust Fan Ventilation Rate : \_\_\_\_\_scfm
- Acetylene on hand: \_\_\_\_\_lbs of gas
- Oxygen on hand: \_\_\_\_\_ lbs of gas
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year \_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_# of Brakes Repaired/year

### BRAKE REPAIR OPERATIONS

- Attach approved MSDS of each welding rod type used in process
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- Particulate Matter Control Efficiency of hood (if available): 1<sup>st</sup> Stage \_\_\_\_\_%; 2<sup>nd</sup> Stage \_\_\_\_\_%
- Exhaust Fan Ventilation Rate : \_\_\_\_\_scfm
- Acetylene on hand: \_\_\_\_\_lbs of gas
- Oxygen on hand: \_\_\_\_\_ lbs of gas
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year \_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_# of Brakes Repaired/year

### BRAKE REPAIR OPERATIONS

- Attach approved MSDS of each welding rod type used in process
- Make \_\_\_\_\_ Model \_\_\_\_\_ Serial # \_\_\_\_\_
- Particulate Matter Control Efficiency of hood (if available): 1<sup>st</sup> Stage \_\_\_\_\_%; 2<sup>nd</sup> Stage \_\_\_\_\_%
- Exhaust Fan Ventilation Rate : \_\_\_\_\_scfm
- Acetylene on hand: \_\_\_\_\_lbs of gas
- Oxygen on hand: \_\_\_\_\_ lbs of gas
- Seasonal Operating Percentage for This Emission Point:  
Spring \_\_\_\_\_% Summer \_\_\_\_\_% Fall \_\_\_\_\_% Winter \_\_\_\_\_% **Note: Total Must Equal 100%**
- Normal Operating Schedule: Start Time \_\_\_\_\_hours/day \_\_\_\_\_days/week \_\_\_\_\_weeks/year \_\_\_\_\_
- Normal Operating Rate: \_\_\_\_\_# of Brakes Repaired/year

## ENV Use Only

FIN, EPN and CIN determination comes from [Emissions Inventory](#)

[illegible]



## HVAC Service/Maintenance Report Log

Building Number \_\_\_\_\_ Appliance/Unit Serial Number \_\_\_\_\_ Total Installed Charge \_\_\_\_\_  
 Maximum Allowable Annual Leakage Rate<sup>1</sup> \_\_\_\_\_

Date	Service / Maintenance Action	Technician	Refrigerant Added (lbs)	Refrigerant Removed (lbs)	Loss Due To <sup>2</sup> Accidental Venting (lbs)	Net Leakage <sup>3</sup> (lbs)	Annualized Leakage Rate <sup>4</sup> (%)	Leak Repaired (Yes/No/NA)	Comments

## Notes:

1. Maximum Annual Leakage = 35% (Refrigeration) or 15% (Air Conditioning).
2. Each time an accidental or unintentional release occurs, the technician must document the release on an accidental/unintentional release form (Attachment (2)).
3. Net Leakage (lb) Since Last Charging = Refrigerant Added (lb) Since Last Charging - Refrigerant Removed (lb) Since Last Charging - Loss Due to Accidental or Unintentional Venting (lb) Since Last Charging.
4. Annualized Leakage Rate = (Net Leakage / Installed Charge) x (365 / Number of Days Since Refrigerant Last Added) x 100.

Maintain for Record Purposes for 5 Years

### Accidental or Unintentional Venting Report

Date \_\_\_\_\_

Location \_\_\_\_\_

Refrigeration Unit \_\_\_\_\_

Type of Refrigerant Vented \_\_\_\_\_ Approx. How Many Pounds Were Vented \_\_\_\_\_

Description of Accidental Venting Incident \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

What Was the Cause of the Release? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

What Precautions Have Been Taken to Prevent This from Happening Again?

\_\_\_\_\_  
\_\_\_\_\_

Technician Name/Rank or Grade \_\_\_\_\_ Certification Number \_\_\_\_\_

Shop Supervisor Signature \_\_\_\_\_ Date \_\_\_\_\_

Shop Supervisor Printed Name and Rank \_\_\_\_\_

Maintain for Record Purposes for 5 Years

Figure: 30 TAC §290.47(d)

**Appendix D: Customer Service Inspection Certificate**

Customer Service Inspection Certificate

Name of PWS \_\_\_\_\_ PWS I.D.# \_\_\_\_\_  
Location of Service \_\_\_\_\_

Reason for Inspection: New construction..... ☐  
Existing service where contaminant hazards are suspected ..... ☐  
Major renovation or expansion of distribution facilities ..... ☐

I \_\_\_\_\_, upon inspection of the private water distribution facilities connected to the aforementioned public water supply do hereby certify that, to the best of my knowledge:

- |   | Compliance               | Non-Compliance           |
|---|--------------------------|--------------------------|
| (1) No direct connection between the public drinking water supply and a potential source of contamination exists. Potential sources of contamination are isolated from the public water system by an air gap or an appropriate backflow prevention assembly in accordance with Commission regulations.  | <input type="checkbox"/> | <input type="checkbox"/> |
| (2) No cross-connection between the public drinking water supply and a private water system exists. Where an actual air gap is not maintained between the public water supply and a private water supply, an approved reduced pressure-zone backflow prevention assembly is properly installed and a service agreement exists for annual inspection and testing by a certified backflow prevention assembly tester. | <input type="checkbox"/> | <input type="checkbox"/> |
| (3) No connection exists which would allow the return of water used for condensing, cooling or industrial processes back to the public water supply.  | <input type="checkbox"/> | <input type="checkbox"/> |
| (4) No pipe or pipe fitting which contains more than 8.0% lead exists in private water distribution facilities installed on or after July 1, 1988.  | <input type="checkbox"/> | <input type="checkbox"/> |
| (5) No solder or flux which contains more than 0.2% lead exists in private water distribution facilities installed on or after July 1, 1988.  | <input type="checkbox"/> | <input type="checkbox"/> |

I further certify that the following materials were used in the installation of the private water distribution facilities:

Service lines	Lead	Copper	<input type="checkbox"/>	PVC	<input type="checkbox"/>	Other	<input type="checkbox"/>
Solder	Lead	Lead Free	<input type="checkbox"/>	Solvent Weld	<input type="checkbox"/>	Other	<input type="checkbox"/>

I recognize that this document shall become a permanent record of the aforementioned Public Water System and that I am legally responsible for the validity of the information I have provided.

Remarks:

\_\_\_\_\_  
Signature of Inspector

\_\_\_\_\_  
Registration Number

\_\_\_\_\_  
Title

\_\_\_\_\_  
Type of Registration

\_\_\_\_\_  
Date

Figure: 30 TAC §290.47(f)

Figure: 30 TAC §290.47(f)

**Appendix F: Sample Backflow Prevention Assembly Test and Maintenance Report**

The following form must be completed for each assembly tested. A signed and dated original must be submitted to the public water supplier for record keeping purposes:

**BACKFLOW PREVENTION ASSEMBLY TEST AND MAINTENANCE REPORT**

NAME OF PWS: \_\_\_\_\_  
PWS I.D. # \_\_\_\_\_  
MAILING ADDRESS \_\_\_\_\_  
CONTACT PERSON \_\_\_\_\_  
LOCATION OF SERVICE: \_\_\_\_\_

The backflow prevention assembly detailed below has been tested and maintained as required by TNRCC regulations and is certified to be operating within acceptable parameters.

**TYPE OF ASSEMBLY**

<input type="checkbox"/> Reduced Pressure Principal	<input type="checkbox"/> Reduced Pressure Principle-Detector
<input type="checkbox"/> Double Check Valve	<input type="checkbox"/> Double Check-Detector
<input type="checkbox"/> Pressure Vacuum Breaker	<input type="checkbox"/> Spill-Resistant Pressure Vacuum Breaker

Manufacturer \_\_\_\_\_ Size \_\_\_\_\_  
Model Number \_\_\_\_\_ Located At \_\_\_\_\_  
Serial Number \_\_\_\_\_

Is the assembly installed in accordance with manufacturer recommendations and/or local codes? \_\_\_\_\_

Figure: 30 TAC §290.47(f)

Figure: 30 TAC §290.47(f)

	Reduced Pressure Principle Assembly			Pressure Vacuum Breaker	
	Double Check Valve Assembly				
	1st Check	2nd Check	Relief Valve	Air Inlet	Check Valve
Initial Test	Held at ____ psid  Closed Tight <input type="checkbox"/> Leaked <input type="checkbox"/>	Held at ____ psid  Closed Tight <input type="checkbox"/> Leaked <input type="checkbox"/>	Opened at ____ psid  Did not open <input type="checkbox"/>	Opened at ____ psid  Did not open <input type="checkbox"/>	Held at ____ psid  Leaked <input type="checkbox"/>
Repairs and Materials Used					
Test After Repair	Held at ____ psid  Closed Tight <input type="checkbox"/> Leaked <input type="checkbox"/>	Held at ____ psid  Closed Tight <input type="checkbox"/> Leaked <input type="checkbox"/>	Opened at ____ psid	Opened at ____ psid	Held at ____ psid

Test gauge used: Make/Model \_\_\_\_\_ SN: \_\_\_\_\_ Calibration Date: \_\_\_\_\_

Remarks: \_\_\_\_\_

The above is certified to be true at the time of testing.

Firm Name \_\_\_\_\_ Certified Tester \_\_\_\_\_

Firm Address \_\_\_\_\_ Cert. Tester No. \_\_\_\_\_ Date \_\_\_\_\_

Firm Phone # \_\_\_\_\_

\* TEST RECORDS MUST BE KEPT FOR AT LEAST THREE YEARS

\*\* USE ONLY MANUFACTURER'S REPLACEMENT PARTS

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## ENVIRONMENTAL PROTECTION

06/2008

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## U.S. ARMY (DA)

AR 200-5 Pest Management

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1200 Hazard Communication

33 CFR 328 Definitions

40 CFR 61 National Emission Standards for  
Hazardous Air Pollutants

40 CFR 68 Chemical Accident Prevention Provisions

40 CFR 260 Hazardous Waste Management System:  
General40 CFR 261 Identification and Listing of Hazardous  
Waste40 CFR 262 Standards Applicable to Generators of  
Hazardous Waste

40 CFR 279 Standards for the Management of Used Oil

40 CFR 302 Designation, Reportable Quantities, and  
Notification

40 CFR 355 Emergency Planning and Notification

40 CFR 370 Hazardous Chemical Reporting: Community  
Right-To-Know

49 CFR 171 - 178 Hazardous Materials Regulations

## U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (Latest Version) U.S. Army Corps on  
Engineers Safety and Health  
Requirements Manual

## WETLAND MANUAL

Corps of Engineers Wetlands Delineation  
Manual Technical Report Y-87-1

## 1.2 DEFINITIONS

## 1.2.1 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally and/or historically.

## 1.2.2 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

## 1.2.3 Contractor Generated Hazardous Waste

Contractor generated hazardous waste means materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene etc.), waste thinners, excess paints, excess solvents, waste solvents, and excess pesticides, and contaminated pesticide equipment rinse water. The Contractor is responsible to contain and dispose all brought on-site materials and products by recycling or reuse through manufacturer, local vendors or charitable organizations. Disposal at construction site is prohibited. Disposal to landfill or other disposal facility shall be pre-approved. The Contractor is responsible to provide MSDS of all products or construction material brought on-site for review and approval by the DPW-Environmental Office, Hazardous Waste Materials Program Management.

## 1.2.4 Installation Pest Management Coordinator

Installation Pest Management Coordinator (IPMC) is the individual officially designated by the Installation Commander to oversee the Installation Pest Management Program and the Installation Pest Management Plan.

## 1.2.4 Project Pesticide Coordinator

The Project Pesticide Coordinator (PPC) is an individual that resides at a Civil Works Project office and that is responsible for oversight of pesticide application on Project grounds.

## 1.2.5 Land Application for Discharge Water

The term "Land Application" for discharge water implies that the Contractor shall discharge water at a rate which allows the water to percolate into the soil. The construction site storm water discharge

shall have an EPA or state permit. The Contractor shall routinely assess non-storm water discharge per Section 01 57 24.00 44 STORM WATER POLLUTION PREVENTION PLAN ensuring no sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" shall occur. Land Application shall be in compliance with all applicable Federal, State, and local laws and regulations.

#### 1.2.6 Pesticide

Pesticide is defined as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, or intended for use as a plant regulator, defoliant or desiccant.

#### 1.2.7 Pests

The term "pests" means arthropods, birds, rodents, nematodes, fungi, bacteria, viruses, algae, snails, marine borers, snakes, weeds and other organisms (except for human or animal disease-causing organisms) that adversely affect readiness, military operations, or the well-being of personnel and animals; attack or damage real property, supplies, equipment, or vegetation; or are otherwise undesirable.

#### 1.2.8 Surface Discharge

The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "waters of the United States" and would require a permit to discharge water from the governing agency.

#### 1.2.9 Waters of the United States

All waters which are under the jurisdiction of the Clean Water Act, as defined in 33 CFR 328.

#### 1.2.10 Wetlands

Wetlands means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, and bogs. Official determination of whether or not an area is classified as a wetland must be done in accordance with WETLAND MANUAL.

### 1.3 GENERAL REQUIREMENTS

The Contractor shall minimize environmental pollution and damage that may occur as the result of construction operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract. The Contractor shall comply with all applicable environmental Federal, State, and local laws and regulations. The Contractor shall be responsible for any delays resulting from failure to comply with environmental laws and regulations.

#### 1.4 SUBCONTRACTORS

The Contractor shall ensure compliance with this section by subcontractors.

#### 1.5 PAYMENT

No separate payment will be made for work covered under this section. The Contractor shall be responsible for payment of fees associated with environmental permits (i.e. storm water, digging, etc.), application, and/or notices obtained by the Contractor, such as for paint booths, welding, brake and clutch service, oil water separator, fuel storage tank, on-site septic system, storm water construction permits, utilities, digging, Texas Department of Health (TDH) Demolition/Renovation Notification Form, and occupational safety and health. In addition, the Contractor shall be responsible for all licenses and permits required for workers, sub-contractors, and transporters. All costs associated with this section shall be included in the contract price. The Contractor shall be responsible for payment of all fines/fees for violation or non-compliance with Federal, State, Regional and local laws and regulations. All required fees for permits, registration, certifications, pre-construction NOI, post construction NOT, and Contractor and Government annual permit fee are the Contractor's responsibility.

#### 1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-01 Preconstruction Submittals

###### Environmental Protection Plan; G

The environmental protection plan. When providing a resubmittal to address USACE review comments, the Contractor shall include annotated comment responses along with the resubmitted Environmental Protection Plan (in its entirety).

###### Storm Water Pollution Prevention Plan; G

Submit a copy of the Contractor's Pollution Prevention Plan (SWPPP), including both narrative and the EROSION AND SEDIMENT CONTROL drawings, in accordance with Section 01 57 24.00 44 STORM WATER POLLUTION PREVENTION PLAN.

##### SD-02 Shop Drawings

###### Hazardous Substance Reporting;

The Contractor shall submit a copy of the attached Emergency Planning and Community Right to Know notification and other reports to the Contracting Officer and to the Facility Emergency Coordinator (FEC) as specified in PART 3 paragraph EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW REQUIREMENTS.

## 1.7 ENVIRONMENTAL PROTECTION PLAN

Prior to commencing construction activities or delivery of materials to the site, the Contractor shall submit an Environmental Protection Plan for review and approval by the Contracting Officer. The purpose of the Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues which the Contractor must address during construction. Issues of concern shall be defined within the Environmental Protection Plan as outlined in this section. The Contractor shall address each topic at a level of detail commensurate with the environmental issue and required construction task(s). Topics or issues which are not identified in this section, but which the Contractor considers necessary, shall be identified and discussed after those items formally identified in this section. Prior to submittal of the Environmental Protection Plan, the Contractor shall meet with the Contracting Officer for the purpose of discussing the implementation of the initial Environmental Protection Plan; possible subsequent additions and revisions to the plan including any reporting requirements; and methods for administration of the Contractor's Environmental Plans. The Environmental Protection Plan shall be current and maintained onsite by the Contractor.

### 1.7.1 Compliance

No requirement in this Section shall be construed as relieving the Contractor of any applicable Federal, State, and local environmental protection laws and regulations. During Construction, the Contractor shall be responsible for identifying, implementing, and submitting for approval any additional requirements to be included in the Environmental Protection Plan.

### 1.7.2 Contents

The environmental protection plan shall include, but shall not be limited to, the following:

- a. Name(s) of person(s) within the Contractor's organization who is(are) responsible for ensuring adherence to the Environmental Protection Plan.
- b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site, if applicable.
- c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
- d. Description of the Contractor's environmental protection personnel training program.
- e. An erosion and sediment control plan which identifies the type and location of the erosion and sediment controls to be provided. The plan shall include monitoring and reporting requirements to assure that the control measures are in compliance with the erosion and sediment control plan, Federal, State, and local laws and regulations.
- f. Work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan

should include measures for marking the limits of use areas including methods for protection of features to be preserved within authorized work areas.

g. The Spill Control and Response plan shall include the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by 40 CFR 68, 40 CFR 302, 40 CFR 355, and/or regulated under State or Local laws and regulations (i.e. installation Spill Prevention Control and Countermeasures Plan). The Spill Control Plan supplements the requirements of EM 385-1-1.

1. The name of the contractor designated individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual shall immediately notify the Contracting Officer and Facility Fire Department, Facility Response Personnel, and Facility Environmental Office in addition to the legally required Federal, State, and local reporting channels (including the National Response Center 1-800-424-8802) if a reportable quantity is released to the environment. The plan shall contain a list of the required reporting channels and telephone numbers (i.e. Contracting Officer, facility fire station, facility environmental office, local authorities, etc.).

2. The name and qualifications of the individual who will be responsible for implementing and supervising the containment and cleanup.

3. Training requirements for Contractor's personnel and methods of accomplishing the training.

4. A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.

5. The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency.

6. The methods and procedures to be used for expeditious contaminant cleanup.

h. A non-hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris. The Contractor shall submit a Waste Management Plan in accordance with Section 01 74 19 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT. The plan shall include schedules for disposal. The Contractor shall identify any subcontractors responsible for the transportation and disposal of solid waste. Licenses or permits shall be submitted for solid waste disposal sites that are not a commercial operating facility. Evidence of the disposal facility's acceptance of the solid waste shall be attached to this plan during the construction. The Contractor shall prepare a sample worksheet of the Non-Hazardous Solid Waste Diversion Report and append it in the Environmental Protection Plan (EPP). The report shall be submitted on the first working day after the first quarter that

non-hazardous solid waste has been disposed and/or diverted and shall be for the previous quarter (e.g. the first working day of January, April, July, and October). The report shall indicate the total amount of waste generated and total amount of waste diverted in cubic yards or tons along with the percent that was diverted. A copy of the quarterly REPORT and the signed weight bills or delivery receipts, shall be provided to installation for records.

i. A recycling and solid waste minimization plan with a list of measures to reduce consumption of energy and natural resources. The plan shall detail the Contractor's actions to comply with and to participate in Federal, State, Regional, and local government sponsored recycling programs to reduce the volume of solid waste at the source. The plan shall detail the Contractor's actions to address methods to conserve resources. The recycling program shall address how to implement the Department of the Army requirement of a 50 percent by weight minimum diversion of construction and demolition (C&D) non-hazardous solid waste from landfill disposal or incineration for promoting more efficient use of C&D materials during construction. The plan shall discuss recycling support facilities (i.e. installation recycling, local vendors, reused through charitable organizations, or construction material for new project, etc.) applicable to the site and project. It is necessary for the contractor to record the type and weight of recycled or reused material (see Part k above). The Contractor shall segregate recyclable materials such as cardboard and paperboard, light metal, heavy metal or steel containers, paper, glass, and plastic containers. The Contractor shall contact Installation for special instructions for recycling. Inert material shall be segregated as construction and demolition materials such as clean fill, rock and concrete, asphalt payment, sand, sod, and clean masonry and brick. Some materials may be applicable and reuse as clean fill or base course material if they meet the product specifications and written approvals from the Contracting Officer. Reference Section 01 74 19 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT for additional information.

The Contractor shall conserve natural resources during site clearing and grubbing operations. Trees identified to remain shall be preserved per applicable notes and specifications. Trees identified to be removed in areas for demolition and construction within the installation cantonment area may be shredded on-site and the residue spread over adjacent construction areas for soil amendment. The Contractor shall avoid using any organic material for temporary stabilization in areas that are to be paved. The shredded material used for soil stabilization and erosion control shall be no more than ½-inch diameter and no more than 3-inch in length. This material shall be spread to a thickness of no more than 3-inch in depth unless approved otherwise by the Contracting Officer. Trees to be used for soil amendments and or as mulch may be shredded and the material stockpiled in an area pre-determined and pre-approved by the area office Contracting Office.

j. An air pollution control plan detailing provisions to assure that dust, debris, materials, trash, etc., do not become air borne and travel off the project site. Plan shall identify air permits required for a new facility or modification of an existing facility which may emit air contaminants. Permits shall be obtained in accordance with applicable Federal and state regulations for the

user. (For Texas: reference Texas Commission on Environmental Quality (TCEQ) Rule 116.111 or exempt facility to 30 TAC Chapter 106.) Applications for permits, notifications, and registrations shall be reviewed by the an authorized personnel of the permit facility.

k. A contaminant prevention plan that identifies potentially hazardous substances to be used on the job site; identifies the intended actions to prevent introduction of such materials into the air, water, or ground; and details provisions for compliance with Federal, State, and local laws and regulations for storage and handling of these materials. In accordance with EM 385-1-1, a copy of the Material Safety Data Sheets (MSDS) and the maximum quantity of each hazardous material to be on site at any given time shall be included in the contaminant prevention plan. As new hazardous materials are brought on site or removed from the site, the plan shall be updated.

The Contractor shall provide a list of construction materials, products, and sources, and Material Safety Data Sheets (MSDS) that will be brought to the job site. The MSDS for construction materials and products shall be provided through the Contracting Officer to the Installation's DPW-Environmental Office. The following is a list of items but it is not conclusive: floor tile, tile mastic, ceiling tile, roofing material, drywall, recycled/recovered materials, fertilizers, pesticides, storm water control structure using compost mulch, paint, joint sealant, grout, and fuel.

o. A waste water management plan that identifies the methods and procedures for management and/or discharge of waste waters which are from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines

p. A historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on the project site: and/or identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in the area are discovered during construction. The plan shall include methods to assure the protection of known or discovered resources and shall identify lines of communication between Contractor personnel and the Contracting Officer.

q. A pesticide treatment plan shall be included and updated, as information becomes available. The plan shall include: sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (i.e. pounds of active ingredient applied), equipment used for application and calibration of equipment. The Contractor is responsible for Federal, State, Regional and Local pest management record keeping and reporting requirements as well as any additional Installation Project Office specific requirements. Termite mitigation design (vertical and horizontal control), construction of design control and treatment is required



for vertical building structures. Environmental sustainable method for termite mitigation shall be utilized. The Contractor shall follow AR 200-5 Pest Management, Chapter 2, Section III "Pest Management Records and Reports" for data required to be reported to the Installation.

#### 1.7.3 Appendix

Copies of all environmental permits, permit application packages, approvals to construct, notifications, certifications, reports, and termination documents shall be attached, as an appendix, to the Environmental Protection Plan.

#### 1.8 PROTECTION FEATURES

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any on-site construction activities, the Contractor and the Contracting Officer shall make a joint condition survey. Immediately following the survey, the Contractor shall prepare a brief report including a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. This survey report shall be signed by both the Contractor and the Contracting Officer upon mutual agreement as to its accuracy and completeness. The Contractor shall protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference which their preservation may cause to the Contractor's work under the contract.

#### 1.9 NOT USED

#### 1.10 ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations, requested by the Contractor, from the drawings, plans, and specifications which may have an environmental impact will be subject to approval by the Contracting Officer and may require an extended review, processing, and approval time. The Contracting Officer reserves the right to disapprove alternate methods, even if they are more cost effective, if the Contracting Officer determines that the proposed alternate method will have an adverse environmental impact.

#### 1.11 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with Federal, State, or local environmental laws or regulations, permits, and other elements of the Contractor's Environmental Protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or equitable adjustments allowed to the Contractor for any such suspensions. This is in addition to any other actions the Contracting Officer may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

### 1.11.1 Demolition

The Contractor shall notify EPA (per 40 CFR 61 Subpart M) or the appropriate regulatory agency, or in Texas, the Texas Department of Health, in writing, at least 10 working days prior to commencement of demolition work. The Contractor shall prepare the "Demolition/Renovation Notification Form" and obtain signature of an authorized person from the building (to be demolished) owner's environmental office. The Contractor shall allow at least 10 working days for obtaining signature from the authorized person. The Contractor is responsible to mail the signed notification form by certified mail with return receipt requested. A copy of the signed notification and a copy of the return receipt shall be provided to the Contracting Officer Representative (COR) and the authorized person. In Texas, in compliance with the Texas Asbestos Hazard Protection Rules (TAHPA), Section 295.61, this notification process is necessary prior to demolition of building structures with or without Asbestos Containing Material. The notification form is available on <http://www.tdh.state.tx.us/beh/asbestos/default.HTM>, then click on Notification & Information Section/ Download Demolition/Renovation Forms.

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION

### 3.1 ENVIRONMENTAL PERMITS AND COMMITMENTS

The Contractor shall be responsible for obtaining and complying with all environmental permits and commitments required by Federal, State, Regional, and local environmental laws and regulations.

### 3.2 LAND RESOURCES

The Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, the Contractor shall identify any land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. The Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, soil, or other materials displaced into uncleared areas shall be removed by the Contractor.

#### 3.2.1 Work Area Limits

Prior to commencing construction activities, the Contractor shall mark the areas that need not be disturbed under this contract. Isolated areas within the general work area which are not to be disturbed shall be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, any markers shall be visible in the dark. The Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

### 3.2.2 Landscape

Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques. The Contractor shall restore landscape features damaged or destroyed during construction operations outside the limits of the approved work area.

### 3.2.3 Erosion and Sediment Controls

The Contractor shall be responsible for providing erosion and sediment control measures in accordance with Federal, State, and local laws and regulations. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's construction activities. The area of bare soil exposed at any one time by construction operations should be kept to a minimum. The Contractor shall construct or install temporary and permanent erosion and sediment control best management practices (BMPs). The Contractor shall not use seeding, turfing, or other organic materials to stabilize the temporary disturbed site if landscaping is required for final or permanent stabilization. BMPs may include, but not be limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. Temporary measures shall not be removed until the area has been stabilized.

### 3.2.4 Contractor Facilities and Work Areas

The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only when approved. Erosion and sediment controls shall be provided for on-site borrow and spoil areas to prevent sediment from entering nearby waters. Temporary excavation and embankments for plant and/or work areas shall be controlled to protect adjacent areas.

## 3.3 WATER RESOURCES

The Contractor shall monitor construction activities to prevent pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation unless otherwise indicated. All water areas affected by construction activities shall be monitored by the Contractor. For construction activities immediately adjacent to impaired surface waters, the Contractor shall be capable of quantifying sediment or pollutant loading to that surface water when required by State or Federally issued Clean Water Act permits.

### 3.3.1 Cofferdams, Diversions, and Dewatering Operations

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure shall be controlled at all times to maintain compliance with existing State water quality standards and designated uses of the surface water body. The Contractor shall comply with the State of Texas water quality standards.

### 3.3.2 Stream Crossings

Stream crossings shall allow movement of materials or equipment without violating water pollution control standards of the Federal, State, and local governments.

### 3.3.3 Wetlands

The Contractor shall not enter, disturb, destroy, or allow discharge of contaminants into any wetlands.

### 3.3.4 Storm Water Pollution Prevention Plan

The Contractor shall reference Section 01 57 24.00 44 STORM WATER POLLUTION PREVENTION PLAN for submittal requirement.

## 3.4 AIR RESOURCES

Equipment operation, activities, or processes performed by the Contractor shall be in accordance with all Federal and State air emission and performance laws and standards.

### 3.4.1 Particulates

Dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants; shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the Federal, State, and local air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The Contractor must have sufficient, competent equipment available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs. The Contractor shall comply with all State and local visibility regulations.

### 3.4.2 Odors

Odors from construction activities shall be controlled at all times. The odors shall not cause a health hazard and shall be in compliance with State regulations and/or local ordinances.

### 3.4.3 Sound Intrusions

The Contractor shall keep construction activities under surveillance and control to minimize environment damage by noise. The Contractor shall comply with the provisions of the State of Texas rules.

### 3.4.4 Burning

Burning is prohibited on the Government premises.

### 3.5 SOLID WASTE AND CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

Disposal of wastes shall be as directed below, unless otherwise specified in other sections and/or shown on the drawings.

#### 3.5.1 Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. Handling, storage, and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. Transport solid waste and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. Waste materials shall be hauled to the Fort Hood Sanitary landfill. The Contractor shall comply with with installation landfill site procedures as described in Section 01 35 10.00 44 Special Project Procedures for Fort Hood. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate.

#### 3.5.2 Chemicals and Chemical Wastes

Chemicals shall be dispensed ensuring no spillage to the ground or water. Periodic inspections of dispensing areas to identify leakage and initiate corrective action shall be performed and documented. This documentation will be periodically reviewed by the Government. Chemical waste shall be collected in corrosion resistant, compatible containers. Collection drums shall be monitored and removed to a staging or storage area when contents are within 6 inches of the top. Wastes shall be classified, managed, stored, and disposed of in accordance with Federal, State, and local laws and regulations.

#### 3.5.3 Contractor Generated Hazardous Wastes/Excess Hazardous Materials

Hazardous wastes are defined in 40 CFR 261, or are as defined by applicable State and local regulations. Hazardous materials are defined in 49 CFR 171 - 178. The Contractor shall, at a minimum, manage and store hazardous waste in compliance with 40 CFR 262 and shall manage and store hazardous waste in accordance with the Installation hazardous waste management plan (reference Section 01 35 10.00 44 SPECIAL PROJECT PROCEDURES FOR FORT HOOD). The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing. The Contractor shall segregate hazardous waste from other materials and wastes, shall protect it from the weather by placing it in a safe covered location, and shall take precautionary measures such as berming or other appropriate measures against accidental spillage. The Contractor shall be responsible for storage, describing, packaging, labeling, marking, and placarding of hazardous waste and hazardous material in accordance with 49 CFR 171 - 178, State, and local laws and regulations. The Contractor shall transport Contractor generated hazardous waste off Government property within 60 days in accordance with the Environmental Protection Agency and the Department of Transportation laws and regulations. The Contractor shall dispose of hazardous waste in compliance with Federal, State and local laws and regulations. Spills of hazardous or toxic materials shall be immediately reported to the Contracting Officer and the Facility Environmental Office. Cleanup and cleanup costs due to spills shall be the Contractor's responsibility. The Contractor shall coordinate the disposition of hazardous waste with the Facility'sDPW, Hazardous Waste

Manager and the Contracting Officer.

#### 3.5.4 Fuel and Lubricants

Storage, fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants and oil shall be managed and stored in accordance with all Federal, State, Regional, and local laws and regulations. Used lubricants and used oil to be discarded shall be stored in marked corrosion-resistant containers and recycled or disposed in accordance with 40 CFR 279, State, and local laws and regulations. If fuel storage tank is on-site, the Contractor shall obtain approval of the installation environmental office, applicable permit from the regulatory agency, and the fuel storage area shall be in compliance with paragraph Best Management Practices, SECTION 01 57 24.01 44 BASIC STORM WATER POLLUTION PREVENTION PLAN. The fueling area shall have storm water pollution prevention control and provisions for emergency clean-up. The fueling area shall be lined and bermed to contain an accidental release and subsequent pollution of stormwater runoff. A layout and elevation view or detail of such a fuel storage tank and fueling area shall be submitted to the COR for review and approval. The storage tank shall meet the containment requirement per Texas Administrative Code, Title 30, Chapter 334, Underground and Aboveground Storage Tanks, Subchapter F, Aboveground Storage Tank. Storage of fuel on the project site shall be in accordance with all Federal, State, and local laws and regulations.

#### 3.5.5 Waste Water

Disposal of waste water shall be as specified below.

- a. Waste water from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, forms, etc. shall not be allowed to enter water ways or to be discharged prior to being treated to remove pollutants. The Contractor shall dispose of the construction related waste water off-Government property in accordance with all Federal, State, Regional and Local laws and regulations.
- b. For discharge of ground water, the Contractor shall surface discharge in accordance with all Federal, State, and local laws and regulations.
- c. Water generated from the flushing of lines after disinfection or disinfection in conjunction with hydrostatic testing shall be discharged into the sanitary sewer with prior approval and/or notification to the Waste Water Treatment Plant's Operator.

#### 3.6 RECYCLING AND WASTE MINIMIZATION

The Contractor shall participate in State and local government sponsored recycling programs. The Contractor is further encouraged to minimize solid waste generation throughout the duration of the project.

#### 3.7 NON-HAZARDOUS SOLID WASTE DIVERSION REPORT

The Contractor shall maintain an inventory of non-hazardous solid waste

diversion and disposal of construction and demolition debris. The Contractor shall submit a report to the Contracting Officer on the first working day after each fiscal year quarter, starting the first quarter that non-hazardous solid waste has been generated. The following shall be included in the report:

- a. Construction and Demolition (C&D) Debris Disposed = \_\_\_\_\_ in cubic yards or tons, as appropriate.
- b. Construction and Demolition (C&D) Debris Recycled = \_\_\_\_\_ in cubic yards or tons, as appropriate.
- c. Total C&D Debris Generated = \_\_\_\_\_ in cubic yards or tons, as appropriate.
- d. Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount) = \_\_\_\_\_ in cubic yards or tons, as appropriate.

### 3.8 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

If during excavation or other construction activities any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. The Contractor shall cease all activities that may result in impact to or the destruction of these resources. The Contractor shall secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources.

### 3.9 BIOLOGICAL RESOURCES

The Contractor shall minimize interference with, disturbance to, and damage to fish, wildlife, and plants including their habitat. The Contractor shall be responsible for the protection of threatened and endangered animal and plant species including their habitat in accordance with Federal, State, Regional, and local laws and regulations.

### 3.10 PREVIOUSLY USED EQUIPMENT

The Contractor shall clean all previously used construction equipment prior to bringing it onto the project site. The Contractor shall ensure that the equipment is free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. The Contractor shall consult with the USDA jurisdictional office for additional cleaning requirements.

### 3.11 MAINTENANCE OF POLLUTION FACILITIES

The Contractor shall maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

### 3.11.1 Storm Water Pollution Prevention Plan

For construction sites covered by a General Construction Permit for Storm Water Discharges, the Contractor's quality control organization shall inspect pollution control structures and activities in accordance with the applicable Storm Water Construction General Permit and SECTION 01 57 24.00 44 until final stabilization is achieved. A sample Inspection Report form is included in Section 01 57 25.00 44 SWPP PLAN INSPECTION AND MAINTENANCE REPORT FORM. An inspection report for each inspection shall be retained on site by the Contractor. In addition, the Contractor shall furnish a copy of each report to the Contracting Officer.

### 3.12 MILITARY MUNITIONS

In the event the Contractor discovers or uncovers military munitions as defined in 40 CFR 260, the Contractor shall immediately stop work in that area and immediately inform the Contracting Officer.

### 3.13 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel shall be trained in all phases of environmental protection and pollution control. The Contractor shall conduct environmental protection/pollution control meetings for all Contractor personnel prior to commencing construction activities. Additional meetings shall be conducted for new personnel and when site conditions change. The training and meeting agenda shall include: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, wetlands, and endangered species and their habitat that are known to be in the area.

### 3.14 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all areas used for construction in accordance with Contract Clause: "Cleaning Up". The Contractor shall, unless otherwise instructed in writing by the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed area shall be graded, filled and the entire area seeded unless otherwise indicated.

### 3.15 HAZARDOUS SUBSTANCE REPORTING

The Contractor shall comply with the requirements of Sections 301 through 312 of the Emergency Planning and Community Right-to-Know Act (EPCRA), also known as Superfund Amendments and Reauthorization Act (SARA) Title III, as published in 40 CFR 355. The Contractor shall also comply with all state regulations and procedures which result from EPCRA and the hazard communication program requirements of EM 385-1-1. The following planning and reporting requirements involve the Contractor's reporting requirements but are not all inclusive; i.e. transport



regulations are not addressed. It is the Contractor's responsibility to comply with all Federal, state, and local emergency planning and reporting requirements.

### 3.15.1 Definitions and Acronyms

#### 3.15.1.1 CERCLA Hazardous Substance (CHS)

A CERCLA Hazardous Substance (CHS) is any substance listed in Section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act, also referred to as Superfund; the list of substances also appears in Table 302.4 of 40 CFR 302.

#### 3.15.1.2 Contracting Officer (CO)

For purposes of the Emergency Planning and Community Right-to-Know Act (EPCRA), the Contracting Officer (CO) will be considered the site owner or operator's construction representative.

#### 3.15.1.3 Extremely Hazardous Substance (EHS)

An Extremely Hazardous Substance (EHS) is any substance listed in Appendices A and B of 40 CFR 355.

#### 3.15.1.4 Facility Emergency Coordinator (FEC)

Facility Emergency Coordinator (FEC) is the representative of the facility Owner or Operator. The Contractor shall identify the FEC and notify the FEC as described below each time the Contractor brings a hazardous substance onto the construction site.

#### 3.15.1.5 Hazardous Chemical Substance (HCS)

A Hazardous Chemical Substance (HCS) is any substance defined as hazardous under 29 CFR 1910.1200, with exceptions as listed in 40 CFR 370.2; generally any substance with a Material Safety Data Sheet (MSDS).

#### 3.15.1.6 Reportable Quantity (RQ)

Reportable Quantity (RQ) is a specified minimum amount of a CHS or an EHS which, if released, must be reported immediately to the FEC. The RQ for a CHS is listed in Table 302.4 of 40 CFR 302; the RQ for an EHS is 0.45 kg (1 pound).

#### 3.15.1.7 Threshold Planning Quantity (TPQ)

Threshold Planning Quantity (TPQ) is a specified minimum amount of an EHS which, if brought onto the construction site, must be reported within a stated time to the FEC. The TPQ for an EHS is listed in Appendices A and B of 40 CFR 355 or is the quantity published in state code, whichever is less.

### 3.15.2 Hazardous Substance Reporting

Whenever a HCS or an EHS substance is brought onto the construction site, the Contractor shall submit the attached reporting form to the FEC, the fire department with jurisdiction over the site, and the Contracting Officer as described below:

a. within 5 days for an EHS substance which (1) equals or exceeds its TPQ, or (2) is a solid or liquid weighing 225 kg (500 pounds) or more, whichever is less, or

b. within 10 days for a HCS substance which equals or exceeds 10,000 pounds for a solid or 55 gallons for a liquid.

### 3.15.3 Emergency Release Notification for Listed Hazardous Substances

The Contractor shall immediately notify the FEC and the Contracting Officer if there is a release of an EHS or a CHS substance whose quantity equals or exceeds its RQ.

#### 3.15.3.1 Emergency Notification Information

Emergency notifications shall consist of the following information:

a. The Contractor's name, the name and telephone number of the person making the report, and the name and telephone number of the Contractor's contact person;

b. The chemical name and identification;

c. An estimate of the quantity released;

d. The location of the release;

e. The time and duration of the release;

f. The medium receiving the release (air, land, water);

g. Known acute or chronic health risks;

h. Medical advice when necessary; and

i. Recommended community precautions.

#### 3.15.3.2 Follow-Up Notice

Within 5 days of the release, a written follow-up notice of the release shall be provided to the FEC and the Contracting Officer. The written notice shall update information provided in the initial report, provide detailed information on the response actions taken, and provide advice regarding medical attention necessary for exposed individuals.

#### 3.15.3.3 State EPCRA Agency

The Contractor may call the following agency for information about EPCRA requirements:

Texas Department of Health  
Hazard Communication Branch  
West 49th Street  
Austin, Texas 78756  
Telephone Numbers: 1-800-452-2791 (inside Texas)  
512-834-6603 (outside Texas)

Family Life Center, PN 71515, Fort Hood, Texas

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### 3.16 FORMS

The EMERGENCY PLANNING COMMUNITY RIGHT TO KNOW NOTIFICATION form is attached to the end of this Section.

-- End of Section --

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State of \_\_\_\_\_

**EMERGENCY PLANNING COMMUNITY RIGHT TO KNOW  
NOTIFICATION FORM**

Date \_\_\_\_\_

This is a notification that the facility named below stores or has stored a Hazardous Chemical Substance (HCS) or an Extremely Hazardous Substance (EHS) as listed in Section 302(c), Title III of SARA - Emergency Planning and Community Right-to-Know Act of 1986.

INSTRUCTIONS: Print or type all information, except signature.

\_\_\_\_\_  
Name of Construction Facility\_\_\_\_\_  
Storage Location of HS/EHS\_\_\_\_\_  
Address\_\_\_\_\_  
Facility Emergency Coordinator\_\_\_\_\_  
City State Zip Code\_\_\_\_\_  
Telephone Number\_\_\_\_\_  
Name and Company of Person  
Completing Form\_\_\_\_\_  
Signature of Person Completing Form**CHEMICAL DESCRIPTION****CHEMICAL CHARACTERISTICS**\_\_\_\_\_  
Product Name

Description Hazard

\_\_\_\_\_  
Chemical Name(s)☐ Pure ☐ Fire\_\_\_\_\_  
CAS Number(s)☐ Mixture ☐ Pressure\_\_\_\_\_  
Maximum Quantity On-Site☐ Solid ☐ Reactivity\_\_\_\_\_  
Average Daily Quantity On Site☐ Liquid ☐ Acute☐ Gas ☐ Chronic

FOR EHS or CHS

TYPE OF HAZARDOUS SUBSTANCE

☐ EHS ☐ CHS\_\_\_\_\_  
Threshold Planning Quantity\_\_\_\_\_  
Reportable Quantity

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## SECTION 01 57 23

## TEMPORARY STORM WATER POLLUTION CONTROL

06/09

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM D 4439	(2004) Geosynthetics
ASTM D 4491	(1999a; R 2004e1) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(2004) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(2008) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(2004) Determining Apparent Opening Size of a Geotextile
ASTM D 4873	(2002) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

## U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 832-R-92-005	(1992) Storm Water Management for Construction Activities Developing Pollution Preventions and Plans and Best Management Practices
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## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 122.26	Storm Water Discharges (Applicable to State NPDES Programs, see section 123.25)
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## 1.2 SYSTEM DESCRIPTION

The work consists of implementing the storm water pollution prevention measures to prevent sediment from entering streams or water bodies as specified in this Section in conformance with the requirements of SECTION 01 57 24.01 STORM WATER POLLUTION PREVENTION PLAN, and the requirements of the National Pollution Discharge Elimination System (NPDES) permit or applicable state Pollution Discharge Elimination System.



### 1.3 EROSION AND SEDIMENT CONTROLS

#### 1.3.1 Stabilization Practices

The stabilization practices to be implemented include temporary seeding, mulching, geotextiles, sod stabilization, vegetative buffer strips, erosion control matts, protection of trees, preservation of mature vegetation, etc. On the daily CQC Report, record the dates when the major grading activities occur, (e.g., clearing and grubbing, excavation, embankment, and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated.

##### 1.3.1.1 Unsuitable Conditions

Where the initiation of stabilization measures by the fourteenth day after construction activity temporarily or permanently ceases or is precluded by unsuitable conditions caused by the weather, initiate stabilization practices as soon as practicable after conditions become suitable.

##### 1.3.1.2 Burnoff

Burnoff of the ground cover is not permitted.

##### 1.3.1.3 Protection of Erodible Soils

Immediately finish the earthwork brought to a final grade, as indicated or specified, and protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

#### 1.3.2 Erosion, Sediment and Stormwater Control

a. Submit "Erosion and Sediment Controls" (E&S) (form provided at the pre-construction conference) and Storm Water Inspection Reports for General Permit to the Contracting Officer once every 7 calendar days and within 24 hours of a storm event that produces 0.5 inch or more of rain.

b. Submit "Erosion and Sediment Control Reports" (E&S) (form provided at the pre-construction conference) and "Stormwater Inspections for General Permit NCG010000 - Land Disturbing Activities" (form provided at [http://h2o.enr.state.nc.us/su/PDF Files/SW General Permits/NCG01 Inspect log.pdf](http://h2o.enr.state.nc.us/su/PDF%20Files/SW%20General%20Permits/NCG01%20Inspect%20log.pdf)) to the Contracting Officer once every 7 days and within 24 hours of a storm event that produces 0.5 inch or more of rain.

d. Not used.

e. Storm Water Notice of Intent for Construction Activities

f. Submit a Storm Water Notice of Intent for NPDES coverage under the general permit for construction activities and a Storm Water Pollution Prevention Plan (SWPPP) for the project to the Contracting Officer prior to the commencement of work. The SWPPP shall meet the requirements of the State of Texas general permit for storm water discharges from construction sites. Submit the SWPPP along with any required Notice of Intent, Notice of Termination, and appropriate permit fees, via the Contracting Officer, to the appropriate Texas

Commission of Environmental Quality (TCEQ) agency for approval, while meeting the required waiting periods for document submission and land disturbance commencement. Maintain an approved copy of the SWPPP at the construction on-site office, and continually update as regulations require, to reflect current site conditions. Include within the SWPPP:

- (1) Identify potential sources of pollution which may be reasonably expected to affect the quality of storm water discharge from the site.
- (2) Describe and ensure implementation of practices which will be used to reduce the pollutants in storm water discharge from the site.
- (3) Ensure compliance with terms of the State of Texas general permit for storm water discharge.
- (4) Select applicable best management practices from EPA 832-R-92-005.
- (5) Include a completed copy of the Registration Statement, BMP Inspection Report Template and Notice of Termination except for the effective date.
- (6) Storm Water Pollution Prevention Measures and Notice of Intent 40 CFR 122.26, EPA 832-R-92-005. Provide a "Storm Water Pollution Prevention Plan" (SWPPP) for the project. The SWPPP will meet the requirements of the State of Texas general permit for storm water discharges from construction sites. Submit the SWPPP along with any required Notice of Intent, Notice of Termination, and appropriate permit fees, via the Contracting Officer, to the TCEQ for approval, prior to the start of construction while adhering to the permit required waiting periods. A copy of the approved SWPPP will be kept at the construction on-site office, and continually updated as regulations require to reflect current site conditions.

#### 1.3.3 Stormwater Drainage

There will be no discharge of excavation ground water to the sanitary sewer, storm drains, or to the river without prior specific authorization of the Environmental Programs Division in writing. Discharge of hazardous substances will not be permitted under any circumstances. Construction site runoff will be prevented from entering any storm drain or the river directly by the use of straw bales or other method suitable to the Environmental Programs Division of the Shipyard. Provide erosion protection of the surrounding soils.

#### 1.3.4 Structural Practices

Implement structural practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement structural practices in a timely manner, during the construction process, to minimize erosion and sediment runoff. Include the following devices;

##### 1.3.4.1 Silt Fences

Provide silt fences as a temporary structural practice to minimize erosion

and sediment runoff. Properly install silt fences to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, and grading). Install silt fences in the locations indicated on the drawings. Final removal of silt fence barriers shall be after establishment of final stabilization. Obtain approval from the Contracting Officer prior to final removal of silt fence barriers.

#### 1.3.4.2 Straw Bales

Provide bales of straw as a temporary structural practice to minimize erosion and sediment runoff. If bales are used, properly place the bales to effectively retain sediment immediately after completing each phase of work (e.g., clearing and grubbing, excavation, embankment, and grading) in each independent runoff area (e.g., after clearing and grubbing in a area between a ridge and drain, place the bales as work progresses, remove/replace/relocate the bales as needed for work to progress in the drainage area). Show on the drawings areas where straw bales are to be used. The Contracting Officer will approve the final removal of straw bale barriers. Provide rows of bales of straw as follows:

- a. Along the downhill perimeter edge of all areas disturbed.
- b. Along the top of the slope or top bank of drainage ditches, channels, swales, etc. that traverse disturbed areas.
- c. Along the toe of all cut slopes and fill slopes of the construction areas.
- d. Perpendicular to the flow in the bottom of existing drainage ditches, channels, swales, etc. that traverse disturbed areas or carry runoff from disturbed areas. Space the rows as shown on the drawings.
- e. Perpendicular to the flow in the bottom of new drainage ditches, channels, and swales. Space the rows as shown on the drawings.
- f. At the entrance to culverts that receive runoff from disturbed areas.

#### 1.3.4.3 Diversion Dikes

Build diversion dikes with a maximum channel slope of 2 percent and adequately compacted to prevent failure. The minimum height measured from the top of the dike to the bottom of the channel shall be 18 inches. The minimum base width shall be 6 feet and the minimum top width shall be 2 feet. Ensure that the diversion dikes are not damaged by construction operations or traffic. Locate diversion dikes where shown on the drawings.

#### 1.3.5 Sediment Basins

Trap sediment in temporary sediment basins. Select a basin size to accommodate the runoff of a local 25-year storm. Pump dry and remove the accumulated sediment, after each storm. Use a paved weir or vertical overflow pipe for overflow. Remove collected sediment from the site. Institute effluent quality monitoring programs. Install, inspect, and maintain best management practices (BMPs) as required by the general permit. Prepare BMP Inspection Reports as required by the general permit. If required by the permit, include those inspection reports.

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### 1.3.6 Vegetation and Mulch

a. Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

b. Seeding: Provide new seeding where ground is disturbed. Include topsoil or nutriment during the seeding operation necessary to establish a suitable stand of grass.

### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Storm Water Pollution Prevention Plan and Notice of intent for T PDES coverage under the general permit for construction activities

#### SD-06 Test Reports

Storm Water Inspection Reports for General Permit  
Erosion and Sediment Controls

#### SD-07 Certificates

Mill Certificate or Affidavit

Certificate attesting that the Contractor has met all specified requirements.

### 1.5 DELIVERY, STORAGE, AND HANDLING

Identify, store and handle filter fabric in accordance with ASTM D 4873.

## PART 2 PRODUCTS

### 2.1 COMPONENTS FOR SILT FENCES

#### 2.1.1 Filter Fabric

Provide geotextile that complies with the requirements of ASTM D 4439, and consists of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and contains stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure. Provide synthetic filter fabric that contains ultraviolet ray inhibitors and stabilizers to assure a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F. The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE

PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Grab Tensile	ASTM D 4632	100 lbs. min.
Elongation (percent)		30 percent max.
Trapezoid Tear	ASTM D 4533	55 lbs. min.
Permittivity	ASTM D 4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D 4751	20-100

#### 2.1.2 Silt Fence Stakes and Posts

Use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 2 by 2 inches when oak is used and 4 by 4 inches when pine is used, and have a minimum length of 5 feet. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum weight of 1.33 pounds/linear foot and a minimum length of 5 feet.

#### 2.1.3 Mill Certificate or Affidavit

Provide a mill certificate or affidavit attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. Specify in the mill certificate or affidavit the actual Minimum Average Roll Values and identify the fabric supplied by roll identification numbers. Submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

### 2.2 COMPONENTS FOR STRAW BALES

The straw in the bales shall be stalks from oats, wheat, rye, barley, rice, or from grasses such as byhalia, bermuda, etc., furnished in air dry condition. Provide bales with a standard cross section of 14 by 18 inches. Wire-bound or string-tie all bales. Use either wooden stakes or steel posts to secure the straw bales to the ground. Wooden stakes utilized for this purpose, shall have a minimum dimensions of 2 by 2 inches in cross section and have a minimum length of 3 feet. Steel posts (standard "U" or "T" section) utilized for securing straw bales, shall have a minimum weight of 1.33 pounds/linear foot and a minimum length of 3 feet.

## PART 3 EXECUTION

### 3.1 INSTALLATION OF SILT FENCES

Extend silt fences a minimum of 16 inches above the ground surface without exceeding 34 inches above the ground surface. Provide filter fabric from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, splice together filter fabric at a support post, with a minimum 6 inch overlap, and securely sealed. Excavate trench approximately 4 inches wide and 4 inches deep on the upslope side of the location of the silt fence. The 4 by 4 inch trench shall be backfilled and the soil compacted over the filter fabric. Remove silt fences upon approval by the Contracting Officer.

### 3.2 INSTALLATION OF STRAW BALES

Place the straw bales in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another. Install straw bales so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings. Entrench and backfill the barrier. Excavate a trench the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. After the bales are staked and chinked (gaps filled by wedging with straw), backfill the excavated soil against the barrier. Conform the backfill soil with the ground level on the downhill side and build up to 4 inches against the uphill side of the barrier. Scatter loose straw over the area immediately uphill from a straw bale barrier to increase barrier efficiency. Securely anchor each bale by at least two stakes driven through the bale. Drive the first stake or steel post in each bale toward the previously laid bale to force the bales together. Drive stakes or steel pickets a minimum 18 inches deep into the ground to securely anchor the bales.

### 3.3 FIELD QUALITY CONTROL

Maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. Use the following procedures to maintain the protective measures.

#### 3.3.1 Silt Fence Maintenance

Inspect the silt fences in accordance with paragraph, titled "Inspections," of this section. Any required repairs shall be made promptly. Pay close attention to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, replace the fabric promptly. Remove sediment deposits when deposits reach one-half of the height of the barrier. Remove a silt fence when it is no longer required. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall receive erosion control .

#### 3.3.2 Straw Bale Maintenance

Inspect straw bale barriers in accordance with paragraph, titled "Inspections". Pay close attention to the repair of damaged bales, end runs and undercutting beneath bales. Accomplish necessary repairs to barriers or replacement of bales in a promptly manner. Remove sediment deposits when deposits reach one-half of the height of the barrier. At the each end of each row turn bales uphill when used to retain sediment. Remove a straw bale barrier when it is no longer required. The immediate area occupied by the bales and any sediment deposits shall be shaped to an acceptable grade. Seed the areas disturbed by this shaping in accordance with UFGS Guide Specification 32 92 19 SEEDING.

#### 3.3.3 Diversion Dike Maintenance

Inspect diversion dikes in accordance with paragraph, titled "Inspections," of this section. Pay close attention to the repair of damaged diversion dikes and accomplish necessary repairs promptly. When diversion dikes are

no longer required, shape to an acceptable grade. Seed the areas disturbed by this shaping in accordance with UFGS Guide Specification 32 92 19 SEEDING.

### 3.4 INSPECTIONS

#### 3.4.1 General

Inspect disturbed areas of the construction site, areas that have not been finally stabilized used for storage of materials exposed to precipitation, stabilization practices, structural practices, other controls, and area where vehicles exit the site.

#### 3.4.2 Inspections Details

Inspect disturbed areas and areas used for material storage that are exposed to precipitation for evidence of, or the potential for, pollutants entering the drainage system. Observe erosion and sediment control measures to ensure that they are operating correctly. Inspect discharge locations or points to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Inspect locations where vehicles exit the site for evidence of offsite sediment tracking.

#### 3.4.3 Inspection Reports

For each inspection conducted, prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, and all other requirements specified in the applicable Construction Storm Water General Permit. Furnish the report to the Contracting Officer within 24 hours of the inspection as a part of the Contractor's daily CQC REPORT. A copy of the inspection report shall be maintained on the job site.

#### 3.4.4 Storm Water Pollution Prevention Plan (SWPPP) Revisions

In compliance with TPDES General Permit TXR 150000 and SECTION 01 57 24.01 44 STORM WATER POLLUTION PREVENTION PLAN, the Contractor is responsible to revise Storm Water Pollution Prevention Plan including the erosion control drawings. The current locations of storm control structures and types shall be depicted on the drawing portion of the on-site SWPPP for regulatory inspection and SWPPP revision record.

-- End of Section --

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04/2010

PART 1      GENERAL

The SWPPP must be submitted to DPW-ENV for review at least 14 days (if not sooner) prior to land disturbing activities. In addition, all operators of the site must submit signed copies of the CSN (and NOI if greater than 5 acres is disturbed) to DPW-ENV at least 14 days (if not sooner) prior to land disturbing activities.

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 110                      Protection of Environment: Subchapter  
D--WATER PROGRAMS, Discharge of Oil

40 CFR 112 Oil Pollution Prevention

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. When providing a resubmittal to address USACE review comments, the Contractor shall include annotated comment responses along with the resubmitted SWPPP (in its entirety). The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Storm Water Pollution Prevention Plan (SWPPP or SWP3); G

The construction Contractor site specific SWPPP shall prevent erosion, sediment loss from the construction site, and erosion down gradient of the developed property. To the maximum extent possible, the SWPPP shall (a) limit the area of disturbance to minimize soil loss and prevent the discharge of water quality impaired water from the construction site and (b) incorporate staged stabilization measures as work progresses throughout the duration of the project. The Contractor shall use the current forms (e.g., NOI, NOT, NOC, etc.) required by the TXR150000 Construction General Permit issued by the Texas Commission on Environmental Quality (TCEQ). Additionally, the Contractor shall maintain compliance with the Construction General Permit

at all times (even when the Construction General Permit is revised by the issuing agency).

The following summarizes some of the requirements that need to be implemented into the SWPPP as required by the TPDES TXR150000 Construction General Permit.

(1) The SWPPP shall comprise of three (3) major parts: (a) narrative, (b) drawings depicting structural and non-structural best management practices (BMPs), and (c) permit required documentation (attachments and worksheets) for record-keeping.

(2) The Contractor site specific SWPPP shall consider the phasing of project tasks with the timing of BMPs and construction activities. Additionally, the Contractor site specific SWPPP shall consider the diversion of storm water run-on onto the disturbed portions of the project site, including limiting the area of exposed soil, and retention of sediments from escaping the exposed portion of the site.

(3) The contract drawings depict recommended or suggested BMP types and locations. Any additional BMPs or modifications to the BMPs throughout the project need to be depicted on the drawings included in the SWPPP as well as the text within the SWPPP.

(4) During construction (after USACE approval of construction operation SWPPP), SWPPP or BMP revision is required when site conditions change and when situations arise that may cause potential permit non-compliance. The SWPPP or BMP revision shall be initiated when requested by the Area Office Contracting Officer (AOCO) or as deemed necessary following an inspection conducted by the Contractor designated inspector.

(5) The NOI (if required to be prepared per the applicable state Construction Storm Water General Permit) shall be separately submitted to all required parties by the construction Contractor and the USACE (if deemed applicable) as co-operators of the construction site.

(6) The Contractor shall sign the Certification of SWPPP, the delegation letter of signatory authorization, the NOI (if required to be prepared per the applicable state Construction Storm Water General Permit), and the Notice of Termination (NOT) as required by the applicable Construction Storm Water permit.

(7) The SWPPP must contain a list of regulated materials and construction materials and products, their location, and methods of containment for each product.

(8) The SWPPP must contain a list of wastes, their location, and method of containment.

(9) The SWPPP shall implement procedures that prevent post construction erosion from occurring. Some examples include the use of Scour Stop or equal as velocity dissipators or the placement of composite fiber turf reinforcement mats at down gradient channels.

(10) The following shall be depicted in the SWPPP drawings.

(a) Location of fuel storage tank and/or fuel transfer points

(b) Location of the concrete wash-out pit

(c) Location of on-site or off-site approved construction support activities, including but not limited to Contractor laydown, storage, stockpile, borrow, spoil, parking areas and drainage features

(d) Location of batch plant (if applicable) and drainage features

(e) Location of the stabilized construction access

The following summarizes some of what is needed to be implemented into the SWPPP as required by the USACE.

(1) The SWPPP drawings shall be prepared on site grading plans. The drawings shall include four phases or stages of Best Management Practices (BMP) structures layout: (a) initial BMP layout at site prior to clearing and grubbing, (b) interim BMP layout during grading activities, (c) temporary stabilization method and locations, and (d) final stabilization method and locations of application. Notes on timing controls and activities shall be described on the SWPPP drawings.

(2) The SWPPP shall be prepared by a registered professional engineer, a Certified Professional in Erosion and Sediment Control (CPESC), or a licensed landscape architect who has experience with the applicable construction storm water permit as well as the use of sediment and erosion control best management practices (BMPs).

(3) The Contractor designated inspector and any person responsible for maintaining SWPPP compliance with the applicable storm water permit and permit required activities shall attend training on storm water erosion and sediment control compliance/inspections provided by the EPA, state, or vendors (e.g., [www.ieca.org](http://www.ieca.org), [www.teex.org](http://www.teex.org), [www.stormwatercenter.org](http://www.stormwatercenter.org), etc.). The inspector shall provide training certificates from accredited vendors confirming course completion. Documented experience that deals with maintaining compliance with the applicable Construction Storm Water Permit may be substituted for the above mentioned training. Documented experience must be attached to the SWPPP.

(4) The person responsible for maintaining the SWPPP shall provide briefing on the approved Construction Operation SWPPP to all on-site workers.

(5) The SWPPP shall not be submitted to the USACE unless it has been verified to meet the requirements of the applicable state Construction Storm Water Permit. Prior to submitting the Notice of Intent (NOI) (if required per the applicable state Construction Storm Water permit) to all required parties, the construction operation SWPPP shall be approved by the USACE.

(6) The SWPPP must contain the Material Safety Data Sheets (MSDS) for each material on-site or provide a reference in the SWPPP on where the sheets can be found at the project site.

(7) The SWPPP must contain a list and identify the location and method of containment for each type of waste that is to be recycled during the project.

(8) The following shall be depicted on the SWPPP drawings.

(a) A statement that verifies an emergency spill clean-up kit and spill containment device is at fuel transfer points at all times.

(b) A statement that verifies fuel tanks or fueling trucks have overfill protection devices.

(c) Construction details for all BMPs used on the construction site (e.g., BMPs for the fuel storage areas, concrete wash-out pit, borrow area, batch plant, stabilized construction access, etc.)

(9) Include a copy of this SECTION.

#### SD-11 Closeout Submittal

##### Notice of Termination; G; PER-EE

If a NOI has been submitted, a copy of the original Notice of Termination (NOT) shall be submitted to the regulatory agency and to all required parties. Prior to submittal of the NOT, Contractor shall inspect the finished site with the Area Office Contracting Officer (AOCO) and obtain photographs to prove establishment of final soil stabilization and removal of BMP controls. A copy of NOT and photographs shall be provided to PER-EE (ATTN: Kathy Mitchell) through the AOCO. The construction Contractor shall retain all documents pertaining to Construction Storm Water Permit for at least three (3) years after NOT submittal.

### 1.3 SUMMARY

Copies of the general permit for storm water discharges associated with construction activity and instructions are available at the following web site:

[http://www.tceq.state.tx.us/nav/permits/sw\\_permits.html](http://www.tceq.state.tx.us/nav/permits/sw_permits.html)  
(PERMIT NO. TXR 150000 for large or small construction site)

The Contractor shall verify that the most current forms (e.g., NOI, NOC, NOT, etc.) are submitted with the SWPPP.

The Contractor shall not commence soil disturbance until approval of the site specific SWPPP is obtained from the USACE along with the USACE SWPPP certification, USACE Construction Site Notice, and USACE NOI (if applicable). Additionally, all required waiting periods as described in

the TXR150000 Construction General Permit must also be met before soil disturbing activities may begin.

There is no separate payment for work required in this section.

#### 1.3.1 Site Operators, Responsibilities, and Shared SWPPP

Both the U.S. Army Corps of Engineers (USACE) and the construction Contractor meet the definitions as operators for the construction activities and operate under a shared SWPPP that addresses the requirements of the TXR150000 Construction General Permit.

The USACE employs other operators and has ability to approve or disapprove changes to plans and specifications. When site conditions change, and the approved SWPPP does not meet storm water permit stipulations, USACE will request the construction Contractor evaluate the BMP control structures or non-structural practices. The day-to-day operator shall install additional structural and non-structural BMP for compliance with storm water permit. The USACE operates under the TXR150000 Construction General Permit as a Secondary Operator.

The Contractor has operational control over construction plans and specifications, including the ability to make modifications to plans and specifications. In addition, the Contractor has day-to-day control of field activities ensuring compliance with storm water permit. The Contractor prepares the construction and operation specific SWPPP and is responsible to establish, inspect, maintain, and rectify the BMPs and perform SWPPP revisions, as well as document Storm Water permit implementation records for the duration of the contract. The Contractor operates under the TXR150000 Construction General Permit as a Primary Operator.

#### 1.4 PROJECT IDENTIFICATION

PROJECT TITLE: Family Life Center \_\_\_\_\_

LOCATION: Fort Hood , Texas

#### 1.5 PROJECT DESCRIPTION

The scope of this project includes construction of new storm sewer, sanitary sewer, access drives, sidewalks, communication system, buildings, and water lines. The total project area of the new construction site includes roughly 4 acres.

#### 1.6 BID OPTIONS AND PROJECT PHASING

There are no Bid Options for this project.

#### 1.7 STANDARD INDUSTRIAL CLASSIFICATION (SIC)/NORTH AMERICAN CLASSIFICATION SYSTEM (NAICS)

STANDARD INDUSTRIAL CLASSIFICATION (SIC)

1542 - General Contractors - Non-Residential Building, other than Industrial Buildings and Warehouses (i.e., administrative buildings)

1623 - Water, Sewer, Pipeline, and Communications and Power Line

## Construction

1771 - Concrete Work (includes asphalt; i.e., access drives and parking lots, culvert construction)

1794 - Excavation Work (include trenching and earth moving)

## NORTH AMERICAN CLASSIFICATION SYSTEM (NAICS)

236220 Commercial and Institutional Building Construction

### 1.8 LOCATION

The SWPPP shall provide a narrative of project location, including street names or easily recognized landmarks. As a minimum, include the following: (1) project site street name and boundary streets, (2) latitude and longitude of the project center to the nearest 15 seconds, or (3) quarter, section, township, and range in which the project is located. Describe all disturbed areas, and off-site support functions and locations for proposed facilities and remote demolition sites. Flow direction arrows showing flow paths to the receiving waters shall be depicted on SWPPP drawings.

### 1.9 RECEIVING WATERS

The SWPPP shall identify the body of water that receives site runoff. If it is a tributary to a major river, identify both the tributary and the river. If runoff is collected by a storm drainage system, identify the operator of the system (i.e. the name of the military installation or municipality, the creek adjacent or on site, and the ultimate receiving water body. Flow arrows showing flow paths to receiving waters shall be depicted on SWPPP drawings.

## PART 2 SITE DESCRIPTION

### 2.1 EXISTING CONDITIONS

The SWPPP shall describe current site conditions. Include information on drainage patterns and runoff coefficients. Also discuss the design storm frequencies used for runoff volume calculations. If the site is located adjacent to an existing industrial facility or in a community greater than 100,000 people, records of storm water quality near your site may be available. Include storm water quality records for the site (if it is available).

### 2.2 FINAL CONDITIONS

The SWPPP shall describe site conditions and drainage upon completion of construction activities. Include estimates of future runoff coefficients. Describe features of storm water system and storm water management (i.e. erosion control and velocity dissipation devices.)

### 2.3 CONSTRUCTION ACTIVITIES

The Contractor shall establish storm water BMP control structures prior to conducting site disturbing activities. The Contractor shall maintain temporary and permanent site stabilization at each portion of site.



The Contractor shall maintain a record of the START date of major construction site activities (i.e., clearing and grubbing, grading, trenching and excavation, dirt moving, etc.), the STOP date when construction activities cease on a portion of the site, and the START date of stabilization measures (such as sod, seeding with native seed, vegetative buffer strips, erosion control compost, turf reinforcement mat, SCOUR STOP, etc.). See SECTION 01 57 25.00 44 SWPP PLAN INSPECTION AND MAINTENANCE REPORT FORM for an example of a grading and stabilization log sheet.

#### 2.4 SOILS DATA

The SWPPP narrative shall provide soils information of the proposed construction site. Possible sources of information are project soil reports, USDA soil survey data, and other published sources. Information can be found at <http://websoilsurvey.nrcs.usda.gov/>.

#### 2.5 STORM WATER POLLUTION PREVENTION DRAWINGS

Each SWPPP drawing shall have a specific sheet number and title.

The following describes the items that need to be identified in the drawings of the SWPPP as required by the TPDES TXR150000 Construction General Permit.

(a) Existing site features and BMPs -- name of receiving waters (e.g., lake, stream, creek, river, unnamed tributary of named receiving stream, etc.), project site storm water discharge locations, existing storm grates, outfall protection devices, and BMPs.

(b) Interim grading site drainage features and BMPs -- slopes with rough grading, limit of soil disturbance area, outline of areas not to be disturbed (e.g., vegetative buffer zones, cultural resources, wetlands, and areas of environmental concern), new storm grates, new drainage outfalls, and BMPs.

(c) Areas to receive temporary stabilization. Methods of stabilization shall be identified along with the applicable specification for the stabilization (e.g., native seed mix at a certain application rate in lbs/sq-ft, etc.).

(d) Areas to receive final stabilization. Methods of stabilization shall be identified along with the applicable specification for the stabilization (e.g., native seed mix at a certain application rate in lbs/sq-ft).

(e) On-site and off-site material borrow areas, clean dirt disposal areas, and BMPs. Stabilized access roads, construction support activities and laydown areas (equipment, staging, parking, and storage areas) along with the BMPs.

(f) Concrete or asphalt batch plant and BMP (if applicable).

The following describes the items that need to be identified in the drawings of the SWPPP as required by the USACE.

(a) BMP construction details for all erosion control and stabilization and sediment control BMPs (e.g., BMPs for the fuel storage areas, concrete wash-out pit, borrow area, batch plant, stabilized construction

access, seeding type, silt fence, etc.)

(b) EROSION AND SEDIMENT CONTROL PLAN I (demolition site)

(c) EROSION AND SEDIMENT CONTROL PLAN II (existing site conditions depicting run-on flow diversion BMPs and run-off BMPs)

(d) EROSION AND SEDIMENT CONTROL PLAN III (interim site grading conditions depicting run-off BMP, swales BMP, storm grates BMP, and temporary stabilization areas & method specification)

(e) EROSION AND SEDIMENT CONTROL PLAN IV (complete site grading conditions depicting run-off BMPs, swales BMPs, storm grates BMPs, and final stabilization areas and method specification)

(f) Notes on timing of controls of activities

### PART 3 BEST MANAGEMENT PRACTICES (BMPs)-EROSION AND SEDIMENT CONTROLS

#### 3.1 TEMPORARY STABILIZATION

Stabilization measures shall be in conformance with Part III.F.2.b.iii of the TXR150000 Construction General Permit.

The Contractor shall provide all necessary labor, services, equipment, materials (e.g., fertilizer) to obtain, transport, apply, and maintain the temporary stabilized area until final stabilization is performed.

Some examples of acceptable methods for temporary stabilization include water sprinkling with environmental sustainable soil binders (e.g., products produced by Soilworks, LLC, DirtGlue Enterprises, SoilLok, or similar) or anchored straw mulching (typically applied at 2 tons per acre). The construction SWPPP may specify other forms of temporary stabilization methods that are industry accepted and are applicable for the project site conditions.

#### 3.2 PERMANENT STABILIZATION

Stabilization measures shall be in conformance with Part III.F.2.b.iii and iv of the TXR150000 Construction General Permit.

The Contractor designated inspector shall inspect the site with the USACE AOCO to ensure final stabilization is established. Final stabilization is defined as described in Part I.B of the TXR150000 Construction General Permit. If final stabilization is unsatisfactory, additional measures shall be required by the USACE AOCO. If applicable, additional seeding shall be performed after temporary removal of the erosion control blankets and subsequent replacement of blankets after such activities are completed. If applicable, the Contractor's SWPPP shall specify the native seed mix species and application rate (lbs/sq-ft). Some examples of acceptable methods for permanent stabilization includes sodding, pavement, and rock blankets.

#### 3.3 SEDIMENT BASIN

The TPDES Storm Water Discharge General Permit requires a temporary sediment basin for sites where 10 acres or more are disturbed at one

time. A temporary sediment basin is not required because construction activities at each portion of the disturbed site is less than 10 acres. The Contractor shall utilize appropriate controls to protect offsite areas from sediment.

### 3.4 STRUCTURAL CONTROLS

See SECTION 01 57 23 TEMPORARY STORM WATER POLLUTION CONTROL.

### 3.5 NON-STRUCTURAL CONTROLS

The Contractor (and the subcontractors) shall be responsible for eliminating pollutants in storm runoff from the project site. The Contractor (and subcontractors) shall be responsible for utilizing non-structural BMPs to minimize storm water pollution. Some examples of non-structural BMP include:

- Construction Practices
- Material Management
- Waste Management
  - Vehicle and Equipment Management
  - Employee and Subcontractor Training
  - Storm Water Pollution Prevention Plan Maintenance

#### 3.5.1 Construction Practices

**Dewatering Operations:** The Contractor (and subcontractor) shall prevent discharge of sediment by methods of sediment control, containment, and disposal. In project areas suspected of potential toxic or petroleum products contamination, the water shall be tested to determine method of disposal.

**Paving Operations:** The Contractor (and subcontractor) shall avoid discharge of pollutants to storm drains by avoiding asphalt and concrete paving in wet weather or anticipation of such event, storing material in covered containers, covering and berming storage areas, establish control structures, cover on-site storm grates, and worker and subcontractor training.

**Structure Construction and Painting:** The Contractor (and subcontractor) shall prevent pollutants in storm runoff by covering, or berming material storage areas, keeping job site clean and orderly, using safer alternate products, stabilizing adjacent disturbed areas, storing material in secondary containment, protecting on-site storm drains, establish control structures, and perform worker and subcontractor training.

**Solid Waste Materials:** Trash and uncontaminated construction debris shall be placed in appropriate covered waste containers. Waste containers shall be emptied regularly and shall not be allowed to overflow. The disposal area of excavated material from project construction shall not be utilized for waste disposal. Routine janitorial service shall be provided for all construction buildings and surrounding grounds. No construction waste materials, including concrete, shall be buried or otherwise disposed of on-site. The Contractor shall brief all on site personnel on good house-keeping and

waste minimization.

**Stockpiles:** Material shall have a storm water perimeter control devices established at a minimum distance of 10 feet from the toe of the stockpile. Materials excavated from utility trenching shall be protected from up gradient storm run-on.

### 3.5.2 Material Management

**Material Delivery and Storage Practice:** The Contractor (and subcontractor) shall prevent or reduce discharge of pollutants to storm water by minimizing the on-site storage of hazardous and toxic (HT) materials, storing HT in clearly labeled, corrosion-resistant containers with secondary containment at designated areas approved by the COR, conducting frequent inspection, keeping current inventory of construction materials on site and training of workers and subcontractor.

**Material Use and Inventory:** Common on-site materials are pesticides and herbicides, fertilizers, detergents, concrete material, petroleum-based products, fertilizers, tar, asphalt, steel reinforcing bars, other hazardous chemicals such as acid, lime, solvents, curing compounds, sealants, paints, glues, fertilizers, etc. The Contractor (and subcontractor) shall use less hazardous, alternate or environmental friendly material, if available. The Contractor shall have (1) a list of construction materials used on site, (2) a list of materials and associated potential pollutants, and (3) method of storage and containment in the Contractor operation specific SWPPP.

**Spill Prevention and Control:** The Contractor (and subcontractor) shall store HT material in covered containers and inside a fenced area, have the temporary fuel storage tank bermed or contained to meet applicable Fire Code, place readily accessible spill clean-up materials, have protocol for immediate work stoppage, notification, clean-up, labeling, storage and packaging, transportation, disposal, record-keeping, closure activities, and provide training to workers and subcontractor for response to spills.

### 3.5.3 Waste Management

**Solid Waste:** Solid waste materials (e.g., grout, mortar or uncontaminated debris) shall be placed in covered containers. Trees and shrubs from site clearing shall be shredded and used as mulching material after site stabilization. Packaging materials such as wood, plastic, and paper shall be recycled to the maximum extent possible and not disposed of in a landfill. It is a requirement to perform recycling (see SECTION 01 74 19 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT). The Contractor shall designate waste containers for segregating waste (municipal, metal, aluminum, plastic, wood pallet, packaging, glass, etc.) Dry paint cans shall be recycled. The Contractor shall designate waste disposal area, have a routine janitorial service for all structures and surrounding grounds, and have a routine schedule to service waste containers. The disposal area of excavated material from project construction shall not be utilized for solid or refuse waste disposal. Personnel on the job site shall be briefed on minimizing disposal to landfill by waste segregation and recycling.

**Hazardous and Toxic Waste:** All excess on-site material such as paints, solvents, petroleum products (e.g., fuel, oil, and grease, etc.),

herbicides, pesticides, acids for cleaning masonry, concrete curing compounds, sealants, paint strippers, wastes from oil-based paint, and glues can become HT waste. Containers of excess material shall be labeled and managed according to the labels and as recommended by the product manufacturers. If there are no instruction provided, the Contractor shall turn in contained waste to the installation DRMO, the local household hazardous waste drop-off, or recycling program.

**Contaminated Soil:** If suspicious of soil contamination during soil moving activities, the Contractor (and subcontractor) shall stop work, notify COR, and establish containment to prevent soil transport or runoff from that location. For removal of contaminated soil, a WORK PLAN shall be prepared for COR approval prior to handling and management of the material. The WORK PLAN shall at least include the following: containment, sampling & analyses, notification to regulatory agencies, transportation, worker safety, training & environmental monitoring, disposal, and documentation and record-keeping.

**Construction and Concrete Waste:** Construction waste or surplus materials, demolition building debris, scrap metal, rubber, plastic, glass, concrete, and masonry products shall be segregated and recycled to minimize landfill disposal. No construction waste shall be buried or disposed of on-site. Concrete waste shall be controlled and minimized by appropriate storage methods for dry and wet materials, and control the amount of concrete and cement mixed on site. Sweepings from exposed aggregate concrete shall be collected and returned to aggregate stockpile and they shall not be washed into streets or storm drains. Concrete wastewater from wash pit is not permitted to discharge as storm runoff. See SECTION 01 57 23 TEMPORARY STORM WATER POLLUTION CONTROL for additional concrete wash-out requirements. After project completion, the Contractor shall contain wastewater, clean the basin, test and dispose of wastewater and sediment in accordance with applicable regulations and to the satisfaction of the USACE AOCO. The Contractor is responsible for all fees, levies, and disposal cost and shall provide a treatment facility signed delivery ticket.

**Sanitary/Septic Waste:** On-site sanitary facilities shall be established at a convenient location. Facility location, design, maintenance, and waste collection practices shall be approved by COR and are in accordance with local regulations. The Contractor (and subcontractor) shall have a routine schedule for waste pump out by a licensed hauler. Septic waste treatment system shall have a pre-construction permit from the local health regulating agency and have contract service with a licensed company. Temporary sanitary facilities discharging to sanitary sewer system shall be approved by the operator of the system and properly connected to avoid illicit discharges. Wastewater from water-based paint shall not be discharged as sanitary waste.

**Building Exterior Cleaning or High-pressure Wash:** Storm drains shall be protected by approved storm water control device. Wash onto dirt area, spade in, settle solids in pit, collect (mop up) and discharge to sanitary sewer (with approval from sewer operator). If the exterior paint contains lead exceeding the levels stated in the Consumer Safety Standard, mercury or mildewcide, the wash water shall be collected and disposed of as regulated material that will require sampling data for disposal to permitted facility.

**Street/Pavement Cleaning:** Water used for this activity shall be

minimized and sediment basin shall be used to contain wastewater. At completion of construction, the silt shall be removed and disposed of in accordance with applicable regulations, and water from the basin shall be pumped to a sanitary sewer with written approval from the COR.

Care of Storm Water from Excavated Areas: Storm water trapped in excavated areas shall be lifted or pumped into a temporary bermed sediment basin or equal measure(s) for sediments removal. The filtered water shall runoff as sheet flow from the sediment removal area. The sediment removal area shall have the maximum separation distance possible from the site drainage outfall.

#### 3.5.4 Dust Control

See UFGS Guide Specification 01 56 00 DUST CONTROL.

#### 3.5.5 Vehicle and Equipment Management

Off-site Vehicle Tracking: The Contractor is required to keep vehicles from tracking soils from the project, borrow, and disposal sites. Temporary parking area(s) to be used 30 calendar days or more for the Contractor's equipment or personal vehicles shall be paved with temporary asphalt. The temporary parking areas shall be removed by the Contractor upon project completion and restored to the satisfaction of the COR.

Vehicle and Equipment Cleaning: Washing shall be performed off site at a commercial washing facility that has an oil/water separator as pre-treatment before connection to municipal sewer system. No vehicle washing is allowed on site, unless washing involves the rinsing of a concrete truck and wastewater is trapped in a washout pit with secondary containment.

Vehicle and Equipment Fueling: Fueling shall be off-site unless a written approval is obtained. If fueling on-site is approved, it shall be at least 150 feet from drainage courses. The Contractor shall provide a construction detail to depict best management practices for fuel storage and fuel transfer/dispensing areas. Fueling operations shall avoid topping of fuel tank, and avoid mobile fueling of mobile construction equipment. Fueling locations shall use impervious secondary containment (i.e., a liquid-tight berm and an impermeable liner). The containment capacity of the bermed area shall provide at least 110 percent (%) of the stored fluid.

It is necessary to have a clean-up kit and containment bloom (or absorbent material) available at all times for immediate clean-up during fueling. No petroleum fuel, oil or lubricants or products tanks are allowed on-site unless is pre-approved in writing. Emergency cut-off valve and or overfill protection device is required on fuel transfer equipment. The temporary fuel containers placed on-site shall meet the industrial standard, labeled and stored in accordance with applicable Federal, state, and local Fire codes.

In case of spill of hazardous, toxic, and radiological waste (HTRW), the Contractor shall stop work, contain spill, notify the AOCO and Safety Office, and execute spill control per the SPILL CONTROL PLAN as required in specification SECTION 01 57 20.00 10 ENVIRONMENTAL PROTECTION. Spill control, response, notification, clean-up, restoration, reporting,

record-keeping, etc. shall be in accordance with 40 CFR 110 and 40 CFR 112, other applicable Federal, state, and local regulations, and to the satisfaction of the AOCO.

**Vehicle and Equipment Maintenance:** Outdoor vehicle or equipment maintenance is a significant potential source of storm water pollution. Activities often include engine repair, changing fluids, etc. Such activities shall be prohibited at the job site. The construction Contractor shall verify proofs on routine maintenance of construction equipment and vehicles before bringing them to the job site.

**Vehicle and Equipment Parking:** Vehicle or equipment shall be regularly inspected for leaks and schedule routine maintenance to reduce the potential for leaks. If leaks are observed at the job site, such vehicle or equipment shall be repaired immediately or removed from the site.

#### 3.5.6 Employee and Subcontractor Training

The Contractor is responsible for providing training for all workers (including the subcontractor) on the job site. The objectives in training are to provide a clear concept of activities or problems that generate pollutants to storm water, identify solutions (BMPs), promote ownership of the problems and solutions, and integrate feedback into training and BMP implementation. A certificate to verify completion of training shall be signed by all trained personnel and retained in the SWPPP.

#### 3.5.7 Storm Water Pollution Prevention Plan Maintenance

The USACE approved SWPPP shall be readily available to inspector either from the USACE or regulatory agency. The USACE approved BMPs and SWPPP shall be revised at no cost by the construction Contractor when there are changes in site conditions, sequence of construction and operation, when sediments escape from the job site, or as dictated by the results of inspections. The BMPs and SWPPP shall be updated by the construction Contractor upon request of the USACE AOCO.

### PART 4 STORM WATER MANAGEMENT AND PERMANENT CONTROLS

#### 4.1 RUNOFF COMPUTATIONS

The Contractor's computations for the storm drainage design shall indicate the frequency, duration, and rainfall intensity the design is based upon.

#### 4.2 SURFACE DISCHARGE QUALITY

The wastewater from concrete washing activity is prohibited from discharging as surface runoff. See Part 3.6.5 of SECTION 01 57 20.00 10 ENVIRONMENTAL PROTECTION.

#### 4.3 PERMANENT EROSION CONTROL STRUCTURES AND STORM WATER TREATMENT UNIT

The Contractor shall incorporate permanent drainage structures, including concrete curbs and gutters, concrete pavement, asphalt pavement, drainage swales, drainage ditches, turfing, vegetative strip, and pipe

culverts, as necessary to provide erosion control at the project site.

#### 4.4 OUTLET PROTECTION OR OUTFALL VELOCITY DISSIPATION DEVICES

The outlet protection or outfall dissipation device shall provide non-erosive flow conditions at the point of surface water discharge to the ditch or swale and downstream of the outfall or channel.

#### PART 5 TIMING OF CONTROLS AND ACTIVITIES

The general Contractor shall discuss timing (sequence) of controls and construction activities to minimize soil loss from exposed areas in the construction operation SWPPP.

The following list provides a general example of the Timing of Controls and Activities.

- Minimize area of disturbance,
- Preserve existing vegetation at the downgradient portion of the site, do not disturb ground cover until it is necessary to proceed with field work,
- Install stabilized construction access,
- Install BMPs at contractor staging, stockpiles, storage, parking, borrow areas, and stockpiles (on-site and off-site locations), concrete washout pit, fuel storage/transfer area, etc.,
- Install BMP at existing storm grates (e.g., curb inlets surface inlets, manholes, catch basins, etc.),
- Install flow diversion dike and stabilize. Construct sediment trap at the downgradient end of the dike,
- Track weather and protect exposed areas with erosion control measures before anticipated storms arrive.
- Construct outfall, install BMPs at initial impact location, and stabilize flow channel prior to clearing upper watershed,
- Stage construction to the maximum extent possible by disturbing, protecting, and then stabilizing one side of river bank before disturbing the opposite side,
- Stabilize flow channel,
- Clear site for sediment pond (if applicable) and utilize sediment pond skimmer to control overflow,
- Stabilize pond slopes,
- Develop run-on BMP devices and protect loose soil areas,
- Start grading up gradient of site and stabilize disturbed areas,



- Avoid disturbing down slope areas of site until up-gradient disturbed areas are stabilized,
- Delay construction of infiltration measures until the end of project when drainage areas are stabilized,
- Install BMP protections at new storm grates (e.g., curb inlets surface inlets, manholes, catch basins, etc.),
- Protect excavated materials by installing BMP perimeter controls to protect materials from run-on and run-off
- Stabilize stockpiles and install BMPs at least 10 feet from the toe of the material,
- Backfill utility trenches in a timely manner to minimize erosion and soil loss,
- Monitor weather reports to schedule paving (asphalt or concrete), concrete saw cutting, foundation work, dust control, seeding or any activities that will impact run-off,
- Inspect and maintain BMP control structures,
- Evaluate BMP and revise BMP when site conditions or activities change. Assess non-storm water discharges. Maintain Construction General Permit and USACE required field records and training logs,
- Monitor discharge from concrete batch plant(if applicable),
- Maintain stabilized areas until final project acceptance (i.e., watering, fertilize, mow, additional seeding, etc.),
- Verify final stabilization of disturbed areas with AOCO representative. See definition in PART 2.3,
- Remove sediment and BMP control structures once disturbed areas are permanently stabilized and accepted by AOCO. Obtain photographs of site to prove establishment of stabilization and removal of all BMP controls,
- File the Contractor NOT. Provide a copy of NOT through AOCO to PER-EE.

#### PART 6 COMPLIANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS

In compliance with the National Environmental Policy Act of 1969, as amended, the Record of Environmental Consideration (REC) dated March 8, 2010, has been prepared for this proposed action. The REC indicates the proposed action qualifies for a categorical exclusion based upon the following:

CX (C) (1):

CONSTRUCTION OF AN ADDITION TO AN EXISTING STRUCTURE OR NEW CONSTRUCTION ON A PREVIOUSLY UNDISTURBED SITE IF THE AREA TO BE DISTURBED HAS NO MORE THAN 5.0 CUMULATIVE ACRES OF NEW SURFACE DISTURBANCE. THIS DOES NOT INCLUDE CONSTRUCTION OF FACILITIES FOR THE TRANSPORTATION, DISTRIBUTION,

**USE, STORAGE, TREATMENT, AND DISPOSAL OF SOLID WASTE, MEDICAL WASTE, AND HAZARDOUS WASTE.**

There are not any threatened or endangered species habitat in this area and no significant archeological resources. This action will not affect agricultural lands, wetlands, coastal zones, wilderness areas, aquifers, floodplains, wild and scenic rivers, or other areas of critical environmental concern. In compliance with Clean Water Act, Section 402, the Contractor and the subcontractor shall conform with all applicable TPDES General Permit stipulations to discharge storm water during construction. In addition, the Contractor (including the subcontractor) shall comply with the Government approved Contractor's operation specific Storm Water Pollution Prevention Plan, BMP, and contract requirements as stated in this section. The Contractor (and the subcontractor) shall comply with all applicable Federal, state, and local hazardous, toxic, radiological (HTR) waste, municipal waste, sanitary and septic waste disposal regulations.

**PART 7 MAINTENANCE AND INSPECTION PROCEDURES AND QUALIFICATION OF DESIGNATED INSPECTOR**

The Contractor shall designate an inspector on site to ensure Storm Water Permit compliance and perform SWPPP quality control. All BMPs and control structures shall be inspected according to the requirements of Part III.F.7 of the TXR150000 Construction General Permit. The inspector shall inspect adjacent areas daily for direct clean-up of waste materials, debris, and fugitive sediment that are blown or washed off-site.

All protective measures used and identified in the SWPPP must have maintenance performed in conformance with Part III.F.6 of the TXR150000 Construction General Permit.

The designated SWPPP inspector is responsible for maintaining the SWPPP throughout the term of permit coverage in accordance with the TXR150000 Construction General Permit (i.e., Part III.7(d) and (e)). All deficiencies shall be corrected and recorded. An example of a form to record this information can be found in SECTION 01 57 25.00 44 SWPP PLAN INSPECTION AND MAINTENANCE REPORT FORM. A copy of each inspection report form shall also be provided to the AOCO.

**PART 8 PROHIBITION ON NON-STORM WATER DISCHARGES**

In accordance with the Part II.A.3 of the TXR150000 Construction General Permit, non-storm water discharges are prohibited during construction of the project, except for the non-storm water discharges listed below. The following list of non-storm water discharges from active construction sites are allowed and is developed based on the above guideline.

- (a) discharges from fire fighting activities
- (b) uncontaminated fire hydrant flushings
- (c) water from the routine external washing of vehicles, the external portion of buildings or structures, and pavement, where detergents and soaps are not used and where spills or leaks of toxic or hazardous materials have not occurred (unless spilled materials have been removed; and if local, state, or federal regulations are applicable, the materials are removed according to those regulations), and where the purpose is to remove mud, dirt,

or dust

(d) uncontaminated water used for dust control

(e) potable water sources including waterline flushings (excluding discharges of hyperchlorinated water, unless the water is first dechlorinated and discharge are not expected to adversely affect aquatic life)

(f) uncontaminated air conditioning condensate

(g) uncontaminated ground water or spring water, including foundation or footing drains where flows are not contaminated with industrial materials such as solvents

(h) lawn watering and similar irrigation

The Contractor designated Storm Water Inspector shall perform routine inspection to ensure only allowable non-storm water discharges are occurring.

## PART 9 CONTRACTOR COMPLIANCE AND CERTIFICATION

The construction Contractor shall use this SECTION as guidance on how to prepare a construction SWPPP that includes narrative, drawings (see PART 2.5 in this section), and required worksheets. Prior to submitting the NOI (if required to be prepared per the applicable state Construction Storm Water General Permit) to the regulatory agency and all other required parties, the Contractor shall submit the operation and field specific SWPPP with a prepared and signed NOI attached for USACE review and approval. Additionally, a prepared Primary Operator Construction Site Notice shall also be prepared and submitted along with the SWPPP.

The construction Contractor and sub-contractor shall each prepare a SWPPP CERTIFICATION. The SWPPP CERTIFICATION assures responsibility and compliance with the permitted discharges of storm water during construction. As such, the SWPPP submitted for USACE review and approval shall have a SWPPP CERTIFICATION prepared and signed by the appropriate approval authority. The USACE sharing the approved SWPPP shall prepare a SWPPP CERTIFICATION and a Secondary Operator Construction Site Notice. All SWPPP certifications and site notices shall be included and retained in the SWPPP.

### 9.1 CONSTRUCTION SWPPP GUIDELINES

An adequate construction SWPPP includes a narrative, drawings, and required worksheets.

The narrative is a written statement to explain and justify the pollution prevention decisions made for a particular project. The narrative shall contain concise information about existing site conditions, construction phasing, BMP practices, construction schedule, and the performance the BMPs are expected to achieve, and actions to be taken if the performance goals are not achieved, and other pertinent items that may not be contained on the drawings.

The narrative shall identify all operators (see PART 1.3 in this section).

The site grading plans provide a baseline to assist in the preparation of the SWPPP drawings. The drawings shall layout various BMP types, locations, and methods of stabilization in accordance with Part III.F.1(g) of the TXR150000 Construction General Permit and Part 2.5 of

this section.

The SWPPP shall also address the following.

- Describe the location, size, and characteristics of any wetlands, streams, or lakes that are adjacent or in close proximity to the site, and/or will receive discharges from disturbed areas of the project. Also delineate areas with high erosion potential including steep slopes. List Threatened and Endangered Species and Critical Habitats. List Cultural and Historical Resources.

- Clean Water Act Section 404 Memo or Permit Stipulations

- Septic System Permit

- Water well Permit

- Identify if concrete/asphalt plant is at site  
(A batch plant may require coverage of an industrial operation permit)

- Spill Prevention and Control Measures per state or EPA and local requirements

- Spill Response

The general construction Contractor shall file a NOI as the primary operator of the construction site. Submitting by electronic means is the most efficient process for filing an NOI, and therefore recommended. However, the physical address for NOI submission and payment can be found on the NOI form.

#### 9.1.1 On-Site Construction Document, Signage, And Record-Keeping

A copy of each of the following shall be maintained in the USACE approved SWPPP in accordance with the TXR150000 Construction General Permit.

- TPDES TXR 150000 general construction storm water permit,

- Primary Operator (Contractor) Construction Site Notice,

- Contractor NOI,

- Contractor Certification of SWPPP,

- Contractor Signatory Delegation Letter,

- Contractor BMP Inspection and Maintenance Report,

- Qualification documents (e.g., training certificates) for Contractor personnel that maintain any part of the SWPPP,

- Contractor log for recording Major Construction Activities and Subsequent Stabilization Practices,

- Contractor log for describing construction materials stored on-site, their potential pollutants, and method of containment,

- Contractor log for describing waste materials stored on-site and method of storage,
- Contractor's anticipated construction timeline schedule (that includes anticipated dates for soil disturbance),
- Contractor SWPPP training log (if batch plant operation is being conducted),
- Contractor NOT (once the project is complete and the NOT is submitted),
- Contractor Concrete or Asphalt Batch Plant sampling records (if batch plant operation is being conducted),
- USACE Certification of SWPPP,
- USACE NOI (if applicable),
- Secondary Operator (USACE) Construction Site Notice,
- Contractor and the USACE (if applicable) storm water discharge permits after receipt from the regulatory agency.

A copy of each of the following shall be maintained in accordance with USACE requirements.

- Contractor NOT (append a blank form in the SWPPP to be completed once project is finished and approved by the USACE AOCO),
- Contractor SWPPP Revision Log,
- The SWPPP shall contain label tabs or similar to clearly identify each item/section of the SWPPP,
- The SWPPP shall be retained at the project site at all times,
- A spill response action guide (i.e., TCEQ issued RG-285 and installation guide),
- Contractor SWPPP/BMP training log,
- Certification or Notification for a Drinking Water Well and/or Septic Sanitary Sewer System (if applicable).

The Contractor shall post the following near the main entrance of each construction access point.

- Primary Operator (Contractor) Construction Site Notice,
- Secondary Operator (USACE) Construction Site Notice,
- NOI (Contractor),
- NOI (USACE, if applicable),
- Contractor Storm Water Permit authorization letter,
- USACE Storm Water Permit authorization letter (if applicable).

All records pertaining to the Storm Water Permit for discharging water associated with construction site activities shall be maintained, by the construction Contractor, for a minimum of three (3) years from the date that a Notice of Termination (NOT) is submitted to the regulatory

agency. See Part VI of the TXR150000 Construction General Permit.

#### 9.1.2 Storm Water Discharge General Permit Fees And Fines For Non-Compliance

The Contractor shall be responsible for the initial Contractor storm water discharge permit NOI fee and any subsequent annual permit fees during construction (if required per the applicable state Construction Storm Water General Permit). In addition, if a batch plant is on-site, the Contractor is responsible to obtain samples of surface water discharged at the batch plant. A water sample for water quality analysis shall be analyzed by a state accredited laboratory and data shall be submitted to the regulatory agency for the batch plant operation as required by applicable permit regulations.

Any fines levied by regulatory agency regarding non-compliance with TPDES TXR150000 Construction General Permit shall be the Contractor's responsibility.

#### 9.1.3 Regulatory Inspector Visits

If the regulatory agency inspector visits the job site, the workers shall notify the Contractor Designated Storm Water Inspector immediately. The Contractor's Designated Inspector shall contact the USACE AOCO immediately and both of them shall accompany the regulatory agency inspector to walk the construction site. The Contractor's Designated Inspector shall brief workers daily on the BMP and the SWPPP, logistics of a regulatory agency inspector site visit, and avoid having an unattended regulatory agency inspector on the job site. The Designated Inspector shall assign a responsible person in his/her absence to oversight the logistic of regulatory agency inspector site visit.

#### 9.2 NOTICE OF TERMINATION (NOT)/COMPLETION REPORT

Notice of Termination (NOT) is applicable for construction activities that submit an NOI. If applicable, the regulatory agency will automatically send the annual storm water permit payment notice if a NOT is not received in the data base before a set date each year. The Contractor is responsible to pay any annual fee on a construction storm water discharge permit.

At establishment of final stabilization, the Contractor shall have USACE AOCO approve the project's final stabilization as well as remove sediment and BMP sediment controls, obtain pictures of the permanently stabilized site and removal of BMP controls, and written approval from USACE AOCO. The Contractor shall prepare a NOT and submit his/her own NOT to the appropriate regulatory agency and any other applicable contacts (i.e., MS4s, cities identified in the SWPPP, etc.). The Contractor shall provide two (2) copies of the filed NOT and site photos to the USACE AOCO. The AOCO shall retain a copy of the NOT as project closure documentation and forward the other copy of NOT and photos to CESWF-PER-EE.

For all other construction activities (i.e., ones that do not require a filing of an NOT), the Contractor shall file the proper documentation to

the regulatory agency and any other applicable contact (i.e., MS4s, cities identified in the SWPPP, etc.) as described in the TXR150000 Construction General Permit. A copy of this document submittal shall be provided to the USACE AOCO. The AOCO shall retain a copy of the documents sent to the regulatory agency and other applicable contacts as project closure documentation and forward a copy of all the documents and photos to CESWF-PER-EE.

The Contractor is responsible for fines due to non-compliance with closure documentation for the construction activity storm water discharge permit.

### 9.3 NOTIFICATION TO MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4)

A copy of NOI (for large construction site), a copy of the Notice of Change (NOC; if changes occurred after initial NOI is sent to the regulatory agency), and NOT shall be sent by the Contractor to all MS4s and any other applicable contacts (i.e., cities referred to in the SWPPP, etc.).

For small construction activities, the Contractor shall notify the MS4s and any other applicable contacts (i.e., cities referred to in the SWPPP, etc.) in the project area by submitting of a copy of the Small Construction Site Notice.

III Corps & Fort Hood  
Attn: AFZF-PW-ENV (Riki Young)  
Fort Hood, TX 76544-5028  
254-287-6499]

-- End of Section --

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SWPP PLAN INSPECTION AND MAINTENANCE REPORT FORM

06/2009

PART 1 GENERAL

1.1 SWPP PLAN INSPECTION REPORT FORM

-- End of Section Table of Contents --

## SECTION 01 57 25.00 44

SWPP PLAN INSPECTION AND MAINTENANCE REPORT FORM  
06/2009

## PART 1 GENERAL

The form identified below provides a baseline for an inspection report form that can be used while conducting SWPP Plan site inspections. Inspection reports must be prepared and documented in accordance with the applicable Construction Storm Water Permit (i.e., Part III.F.7 of the Texas TXR150000 Construction General Permit, Part IV.D.4 of the Louisiana LAR100000 Construction General Permit, Part III.D of the Louisiana LAR200000 Construction General Permit, and Part 4 of the NPDES General Permit for Storm Discharges from Construction Activities). The form provided below may not be applicable to all states and therefore needs to be verified by the Contractor that it is in compliance with the applicable construction general permit.

1.1 SWPP PLAN INSPECTION REPORT FORM

The following inspection is being performed in compliance with the applicable state's General Permit or the EPA NPDES permit, whichever is applicable, relating to discharges from construction activities (for the State of Texas it is Section F.8 of the TCEQ General Permit No. TXR150000; for the State of Louisiana it is LPDES Permit # LAR 100000 (LARGE construction activity) or LPDES Permit # 200000 (SMALL construction activity)).

STORM WATER PERMIT #: \_\_\_\_\_  
PROJECT NAME: Family Life Center \_\_\_\_\_  
PURPOSE OF INSPECTION: \_\_\_\_\_

INSPECTOR: \_\_\_\_\_ DATE: \_\_\_\_\_  
DAYS SINCE LAST RAINFALL ON: \_\_\_\_\_  
AMOUNT OF LAST RAINFALL: \_\_\_\_\_ INCHES  
( ) ONSITE RAIN GAGE ( ) METEOROLOGICAL TOWER AT: \_\_\_\_\_

IS A CONSTRUCTION SITE NOTICE POSTED: \_\_\_\_\_  
IF YES, LOCATION: \_\_\_\_\_

IS PERMIT ATTACHED TO PLAN: \_\_\_\_\_

IS PLAN CERTIFIED IN ACCORDANCE WITH REGULATIONS: \_\_\_\_\_

## STABILIZATION CONTROL SECTION

For each area of the construction project, use this chart to track the dates of soil disturbing activity, identify stabilization measures, and monitor their effectiveness. Discharge locations should be inspected to check the effectiveness of these erosion control measures.

AREA	DATE LAST	DATE OF NEXT	STABILIZED	STABILIZED
------	-----------	--------------	------------	------------

CONDITION, COMMENTS	DISTURBED	DISTURBANCE	(Y/N/TEMP)	WITH
------------------------	-----------	-------------	------------	------


COMMENTS / STABILIZATION REQUIRED (if appropriate):

## STRUCTURAL CONTROLS SECTION

Use this table to document the effectiveness of each structural control, such as silt fences, berms, riprap, etc. Copy this sheet as required. Discharge locations should be inspected to check the effectiveness of these erosion control measures. See the Installation's Storm Water/Surface Water Pollution Prevention Best Management Practices Guidance Document for correct installation/maintenance methods.

TYPE	LOCATION	INSTALLED CORRECTLY?	EVIDENCE OF EROSION?	MAINTENANCE REQUIRED
------	----------	-------------------------	-------------------------	-------------------------

COMMENTS:

## MATERIAL STORAGE AREAS

EVIDENCE OR POTENTIAL FOR POLLUTANTS ENTERING THE DRAINAGE SYSTEM:

OTHER COMMENTS:

## NON STORM WATER AND NON STRUCTURAL BMP CONTROLS

The following non-storm water discharges from active construction sites are allowed.

- discharges from fire fighting activities,
- uncontaminated fire hydrants flushing,
- water from the routine external washing of vehicles, the external portion of buildings or structures, and pavement, where detergents and soaps are not used and where spills or leaks of toxic or hazardous materials have not occurred (unless spilled materials have been removed; and if local, state, or federal regulations are applicable, the materials are removed according to those regulations), and where the purpose is to remove mud, dirt, or dust,
- uncontaminated water used for dust control,
- potable water sources including waterline flushings (excluding discharges of hypochlorinated water, unless the water is first dechlorinated and discharge are not expected to adversely affect aquatic life),
- uncontaminated air conditioning condensate,
- uncontaminated ground water or spring water, including foundation or footing drains where flows are not contaminated with industrial materials such as solvents,
- and lawn watering and similar irrigation

PROHIBIT DISCHARGING NEW WATER LINE DISINFECTION WASTEWATER AND CONCRETE WASHOUT PIT WASTEWATER. NEUTRALIZE CHLORINE RESIDUAL IN DISINFECTION WASTEWATER TO 4 PPM PER AWWA C651 AND METERED TO SANITARY SEWER OR DISCHARGE TO SEDIMENT POND. EVAPORATE WASHOUT PIT AND RECYCLE CONCRETE.

Family Life Center, PN 71515, Fort Hood, Texas

LOCATIONS WHERE VEHICLES ENTER OR EXIT SITE

EVIDENCE OF OFFSITE SEDIMENT TRACKING:

METHOD TO CORRECT \_\_\_\_\_  
DATE COMPLETE \_\_\_\_\_

OFFSITE DISCHARGES

EVIDENCE OF SEDIMENT OR OTHER POLLUTANTS LEAVING SITE: ( ) YES ( ) NO  
IF YES, LOCATION:

METHOD TO CORRECT \_\_\_\_\_  
DATE COMPLETE \_\_\_\_\_

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## STORM WATER POLLUTION PREVENTION PLAN REVISION

If this inspection has revealed any issues that require an update to the SWPP Plan, include them here.

CHANGES REQUIRED TO THE SWPP PLAN (if appropriate):

---

REASONS FOR CHANGES (if appropriate):

---

LIST ANY ADDITIONAL LOCATIONS WHERE BMPs ARE NEEDED:

---

LIST ANY INCIDENTS OF NONCOMPLIANCE WITH SWPP PLAN AND NECESSARY MODIFICATIONS TO SWPP PLAN:

IS FACILITY IN COMPLIANCE WITH SWPP PLAN AND PERMIT?

---

*If yes, this inspection must be properly signed and certified that the facility is in compliance.*

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Name	Signature	Title
Date		

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-- End of Section --

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CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

**04/2010**

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- 1.3 PLAN
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## SECTION 01 74 19

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT  
04/2010

## PART 1 GENERAL

## 1.1 GOVERNMENT POLICY

Government policy is to apply sound environmental principles in the design, construction and use of facilities. As part of the implementation of that policy the Contractor shall: (1) practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction and demolition waste from landfills and incinerators and facilitate recycling or reuse.

## 1.2 MANAGEMENT

The Contractor shall take a pro-active, responsible role in the management of construction and demolition waste and require all subcontractors, vendors, and suppliers to participate in the effort. Construction and demolition waste includes products of demolition or removal, excess or unusable construction materials, packaging materials for construction products, and other materials generated during the construction process but not incorporated into the work. In the management of waste consideration shall be given to the availability of viable markets, the condition of the material, the ability to provide the material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates. The Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling of waste. Revenues or other savings obtained for salvage, or recycling shall accrue to the Contractor. Firms and facilities used for recycling, reuse, and disposal shall be appropriately permitted for the intended use to the extent required by federal, state, and local regulations.

## 1.3 PLAN

A waste management plan shall be submitted within 7 days after contract award and prior to initiating any site preparation work. The plan shall include the following:

- a. Name of individuals on the Contractor's staff responsible for waste prevention and management.
- b. Actions that will be taken to reduce solid waste generation.
- c. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas and equipment to be used for processing, sorting, and temporary storage of wastes.
- d. Characterization, including estimated types and quantities, of the waste to be generated.
- e. Name of landfill and/or incinerator to be used and the estimated

costs for use, assuming that there would be no salvage or recycling on the project.

f. Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and organizations that accept used materials such as materials exchange networks and Habitat for Humanity.

g. List of specific waste materials that will be salvaged for resale, salvaged and reused, or recycled. Locate and identify labeled and covered dumpsters or containers for types of recycled materials at the job site. Recycling facilities that will be used shall be identified.

h. Identification of materials that cannot be recycled/reused with an explanation or justification.

i. Anticipated net cost savings determined by subtracting Contractor program management costs and the cost of disposal from the revenue generated by sale of the materials and the incineration and/or landfill cost avoidance.

j. Please submit a copy of the waste management plan to the DPW landfill engineer for review. It can be sent to: IMWE-HOD-PWF, Attn: Kevin Scholz, 4612 Engineer Dr., Fort Hood, TX 76544.

#### 1.4 RECORDS

Records shall be maintained to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. The report shall indicate the total amount of waste generated and total amount of waste diverted in cubic yards or tons along with the percent that was diverted. The records (WASTE DIVERSION REPORT), including signed and dated waste delivery receipts, Bills of Lading for land disposed, incinerated, and recycled or reused materials are required. A copy of the records shall be delivered to the Contracting Officer and the Solid Waste Management Office. The report shall be submitted on the first working day after the first quarter that non-hazardous solid waste has been disposed and/or diverted and shall be for the previous quarter (e.g. the first working day of January, April, July, and October).

#### 1.4 COLLECTION

The necessary containers, bins and storage areas to facilitate effective waste management shall be provided and shall be clearly and appropriately identified. Recyclable materials shall be handled to prevent contamination of materials from incompatible products and materials and separated by one of the following methods:

##### 1.4.1 Source Separated Method.

Waste products and materials that are recyclable shall be separated from trash and sorted into appropriately marked separate containers and then transported to the respective recycling facility for further processing.

##### 1.4.2 Co-Mingled Method.

Waste products and recyclable materials shall be placed into a single

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container and then transported to a recycling facility where the recyclable materials are sorted and processed.

#### 1.4.3 Other Methods.

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

### 1.5 DISPOSAL

Except as otherwise specified in other sections of the specifications, disposal shall be in accordance with the following:

#### 1.5.1 Reuse.

First consideration shall be given to salvage for reuse since little or no re-processing is necessary for this method, and less pollution is created when items are reused in their original form. Sale or donation of waste suitable for reuse shall be considered. Salvaged materials, other than those specified in other sections to be salvaged and reinstalled, shall not be used in this project.

#### 1.5.2 Recycle.

Waste materials not suitable for reuse, but having value as being recyclable, shall be made available for recycling whenever economically feasible.

#### 1.5.3 Waste.

Materials with no practical use or economic benefit shall be disposed at a landfill or incinerator.

-- End of Section --

**USACE BIM PROJECT EXECUTION PLAN (USACE PxP)**  
**VERSION 1.0**  
FOR  
**Family Life Center**  
**Fort Hood, TX**  
DEVELOPED BY  
**[AUTHOR COMPANY]**

This template is a tool that is provided to assist in the development of a BIM project execution plan as required per contract. It was adapted from the buildingSMART alliance™ (bSa) Project “BIM Project Execution Planning” as developed by The Computer Integrated Construction (CIC) Research Group of The Pennsylvania State University. The bSa project is sponsored by The Charles Pankow Foundation ([www.pankowfoundation.org](http://www.pankowfoundation.org)), Construction Industry Institute (CII) ([www.construction-institute.org](http://www.construction-institute.org)), Penn State Office of Physical Plant (OPP) ([www.opp.psu.edu](http://www.opp.psu.edu)), and The Partnership for Achieving Construction Excellence (PACE) ([www.engr.psu.edu/pace](http://www.engr.psu.edu/pace)). The BIM Project Execution Planning Guide can be downloaded at [www.engr.psu.edu/BIM/PxP](http://www.engr.psu.edu/BIM/PxP).

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USACE BIM PROJECT EXECUTION PLAN (USACE PxP)  
VERSION 1.0  
FOR  
Family Life Center  
Fort Hood, TX  
DEVELOPED BY  
[AUTHOR COMPANY]

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SECTION A: BIM PROJECT EXECUTION PLANNING GUIDE OVERVIEW

To successfully implement Building Information Modeling (BIM) on a project, [AUTHOR COMPANY] has developed this detailed BIM Project Execution Plan. The BIM Project Execution Plan defines uses for BIM on the project (e.g. design authoring, design reviews, 3D coordination, and record modeling), along with a detailed process for executing BIM on this project.

[INSERT ADDITIONAL INFORMATION: FOR EXAMPLE, A BIM MISSION STATEMENT. This is the location to provide additional BIM overview information up to one paragraph. Additional detailed information can be included as an attachment to this document.]

**Please note: Instructions and examples to assist with the completion of this guide are currently in grey. The text can and should be modified to suit the needs of the organization filling out the template. If modified, the format of the text should be changed to match the rest of the document. This can be completed, in most cases, by selecting the normal style in the template styles.**



SECTION B: PROJECT INFORMATION

This section defines basic project reference information and BIM related project milestones.

1. FACILITY OWNER: US ARMY
2. PROJECT NAME: Family Life Center
3. PROJECT LOCATION: Fort Hood, TX
4. CONTRACT TYPE: DESIGN-BUILD
5. FACILITY TYPE: CoS Religious Facility - Family Life Center
6. BRIEF PROJECT DESCRIPTION: Family Life Center 17000 GSF, Activity Center 10000 GSF
7. ADDITIONAL PROJECT INFORMATION: Family Life Center with Non-Standard Design Activity Center
8. PROJECT NUMBERS:

PROJECT INFORMATION	NUMBER
USACE CONTRACT NUMBER:	[E.G. W9126G-08-D-0000]
TASK ORDER:	W9126G-08-R-0172 DK01
USACE PROJECT NUMBER:	71515
PROJECT NUMBER(S):	[IF APPLICABLE]
Project Code:	FH10
Drawing (File) Number:	F730-18-01





SECTION C: KEY PROJECT CONTACTS

The following is a list of the lead BIM contacts for each organization on the project. Additional contacts can be included later in the document.

ROLE	ORGANIZATION	NAME	EMAIL	TIME ZONE	PHONE
Project Manager	USACE-SWF	William Guldemon	William.M.Guldemon@usace.army.mil	CST	817-886-1671
District BIM Manager	USACE-SWF	Greg Hall	Greg.P.Hall@usace.army.mil	CST	817-886-1984
COS BIM Manager	USACE-NWO	Roger Fujan	Roger.j.fujan@usace.army.mil	CST	402-995-2542
Project Manager(s)	[Company]				
BIM Manager(s)	[Company]				
Architecture Lead	[Company]				
Civil Lead	[Company]				
Electrical/Telecom Lead					
Fire Protection Lead					
Mechanical Lead					
Plumbing Lead					
Structural Lead					
Other Project Roles					



**SECTION D: PROJECT GOALS / BIM OBJECTIVES**

Describe how the BIM Model and Facility Data are leveraged to maximize project value (e.g. design alternatives, life-cycle analysis, scheduling, estimating, material selection, pre-fabrication opportunities, site placement, etc.) Reference [www.engr.psu.edu/bim/download](http://www.engr.psu.edu/bim/download) for BIM Goal & Use Analysis Worksheet.

**1. MAJOR BIM GOALS / OBJECTIVES:**

State BIM Goals / Objectives

BIM GOAL	DESCRIPTION

**2. BIM USES:**

The BIM Uses currently highlighted/shaded/checked(x) are required by USACE RFP Section 01 33 16, Design after Award, Attachment F. Highlight in yellow and place an X next to the additional BIM Uses as selected by the project team. See BIM Project Execution Planning Guide at [www.engr.psu.edu/BIM/BIM\\_Uses](http://www.engr.psu.edu/BIM/BIM_Uses) for Use descriptions. Include additional BIM Uses as applicable in empty cells.

OPERATE	X	CONSTRUCT	X	DESIGN	X	PLAN	X
BUILDING MAINTENANCE SCHEDULING		SITE UTILIZATION PLANNING		DESIGN AUTHORIZING	X	PROGRAMMING	
BUILDING SYSTEM ANALYSIS		CONSTRUCTION SYSTEM DESIGN		DESIGN REVIEWS	X	SITE ANALYSIS	
ASSET MANAGEMENT		3D COORDINATION	X	3D COORDINATION	X		
SPACE MANAGEMENT / TRACKING		DIGITAL FABRICATION		STRUCTURAL ANALYSIS			
DISASTER PLANNING		3D CONTROL AND PLANNING		LIGHTING ANALYSIS			
RECORD MODELING		RECORD MODELING	X	ENERGY ANALYSIS			
				MECHANICAL ANALYSIS			
				OTHER ENG. ANALYSIS			
				LEED EVALUATION			
				CODE VALIDATION			
4D MODELING		4D MODELING		4D MODELING		4D MODELING	
COST ESTIMATION		COST ESTIMATION		COST ESTIMATION		COST ESTIMATION	
EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING	



SECTION E: ORGANIZATIONAL ROLES / STAFFING

For each BIM Use selected, identify the team within the organization (or organizations) who will staff and perform that Use. Submittal of this section to USACE IS NOT REQUIRED.

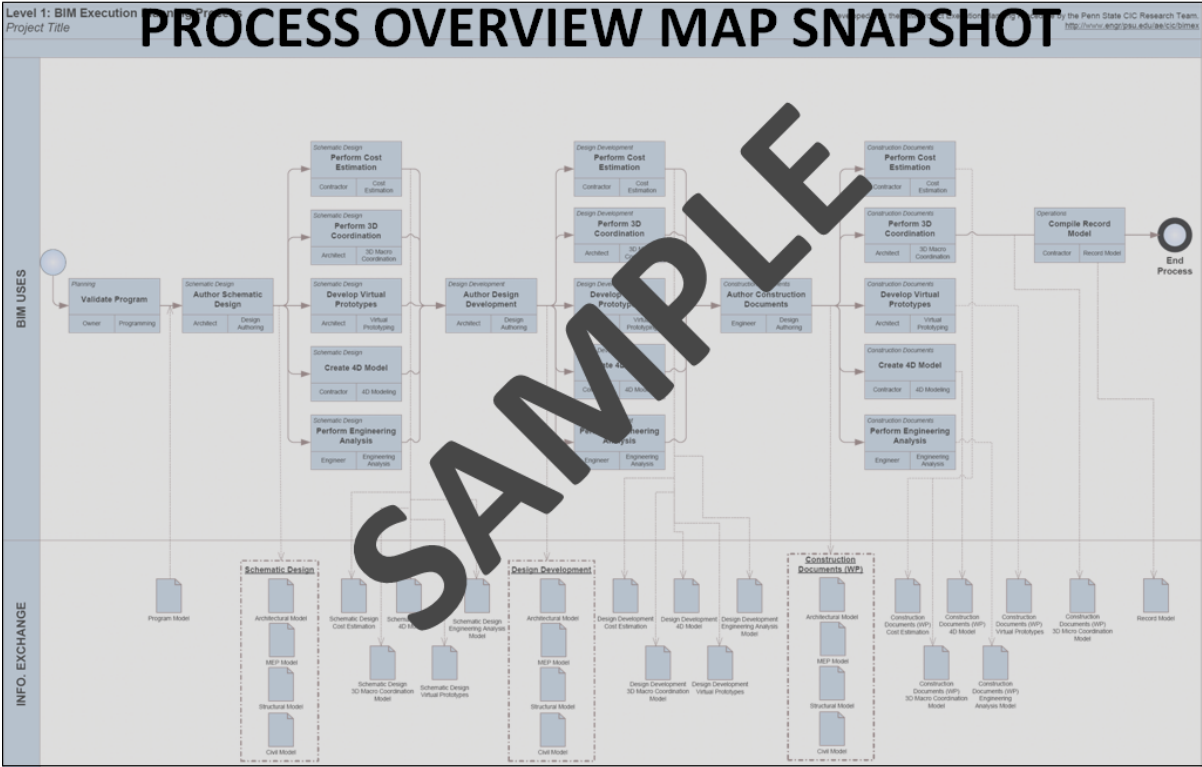
BIM USE	ORGANIZATION	NUMBER OF TOTAL STAFF FOR BIM USE	LOCATION(S)	LEAD CONTACT
3D coordination	Contractor A			
	B			
	C			



SECTION F: BIM PROCESS DESIGN

Provide process maps for each BIM Use selected in section D: Project Goals/BIM Objectives. These process maps provide a detailed plan for execution of each BIM Use. They also define the specific Information Exchanges for each activity, building the foundation for the entire execution plan. The plan includes the Overview Map (Level 1) of the BIM Uses, a Detailed Map of each BIM Use (Level 2), and a description of elements on each map, as appropriate. Level 1 and 2 sample maps are available for download at [www.engr.psu.edu/BIM/download](http://www.engr.psu.edu/BIM/download). (Please note that these are sample maps and should be modified based on project specific information and requirements). Please reference Chapter Three: Designing BIM Project Execution Process in the BIM Project Execution Planning Guide found at [www.engr.psu.edu/BIM/PxP](http://www.engr.psu.edu/BIM/PxP)

1. LEVEL ONE PROCESS OVERVIEW MAP: ATTACHMENT 1



2. LIST OF LEVEL TWO DETAILED BIM USE PROCESS MAP(S): ATTACHMENT 2

- a. Existing Conditions Modeling
  - b. Cost Estimation
  - c. 4D Modeling
  - d. Programming
  - e. Site Analysis
  - f. Design Reviews
  - g. Design Authoring
  - h. Energy Analysis
  - i. Structural Analysis
  - j. Lighting Analysis
  - k. 3D Coordination
  - l. Site Utilization Planning
  - m. 3D Control and Planning
  - n. Record Modeling
  - o. Maintenance Scheduling
  - p. Building System Analysis
- [Delete unused or add additional process maps from list]



## SECTION G: BIM INFORMATION EXCHANGE WORKSHEET

Model elements by discipline, level of detail, and any specific attributes important to the project are documented using information exchange worksheet. See Chapter Four: Defining the Requirements for Information Exchanges in the BIM Project Execution Planning Guide for details on completing this template. Submittal of these worksheets to USACE IS NOT REQUIRED.

### 1. LIST OF INFORMATION EXCHANGE WORKSHEET(S): ATTACHMENT 3

(The following are examples. Modify for specific project. Some Information Exchanges may need to be removed, while some information exchanges may need to be added.)

- a. Existing Conditions Modeling
- b. Cost Estimation
- c. Phase Planning
- d. Programming
- e. Site Analysis
- f. Design Reviews
- g. Design Authoring
- h. Energy Analysis
- i. Structural Analysis
- j. Lighting Analysis
- k. 3D Coordination
- l. Site Utilization Planning
- m. 3D Control and Planning
- n. Record Modeling
- o. Maintenance Scheduling
- p. Building System Analysis

[Delete unused and add additional information exchange worksheets from list]



**SECTION H: BIM AND FACILITY DATA REQUIREMENTS****1. MODEL OUTPUT MATRIX**

In this template, the non-shaded sub-category rows may be added or modified per project requirements. Select the column that best describes the type of information that will be delivered.. SEE USACE RFP SECTION 01 33 16 DESIGN AFTER AWARD, ATTACHMENT F, SECTION 4.0 FOR REQUIREMENTS. Please note: No graphical representation without Facility Data is to be contained in the Model. Below are descriptions of the columns:

- 3D w/ facility data – 3D graphical representation with associated intelligent attribute data.
- 2D w/ facility data – 2D graphical representation with associated intelligent attribute data.
- 2D w/o facility data – 2D graphical representation without associated intelligent attribute data.
- Description/Remarks – Additional information used to explain facility data.

MODEL ELEMENT BREAKDOWN	3D W/ FACILITY DATA	2D W/ FACILITY DATA	2D W/O FACILITY DATA	DESCRIPTION/REMARKS
<b>4.2 Architectural/Interior Design</b>				
<b>4.2.1 Spaces</b>				
Net Square Footage and Volumes				
Room Name and Number				
Programmatic Information				
<b>4.2.2 Walls and Curtain Walls</b>				
Wall Dimensions/Thickness				
Wall Type (A1, A2, B, etc)				
Wall Composition (CMU, Concrete)				
Wall Rating (1 hr., 30 min.)				
Details				
Sections				
<b>4.2.3 Doors, Window and Louvers</b>				
Windows, Doors and Louvers				
Type				
Hardware Type, Frame Mat'l, Glass Type, Door Leaf				
Signage				
Door Legend				
Head, Sill, Jam Details				
<b>4.2.4 Roof</b>				
Roof Dimensional Information				
Type (EPDM, Standing Seam, etc)				
Composition (Membrane, insulations, deck, joist, etc)				
<b>4.2.5 Floors</b>				
Floor Dimensional Information				
Rating				
Finishes (Carpet, VCT, etc)				
Floor Composition (Concrete, Deck, Joist, etc)				
<b>4.2.6 Ceilings</b>				
Ceiling Plane/Dimensions				
Layout (grids, patterns, etc)				
Composition (ACT, GWB, Exposed)				
<b>4.2.7 Vertical Circulations</b>				
Finished Dimensions of Openings				
Shaft Clear Dimensions				
Shaft Construction Materials				
<b>4.2.8 Architectural Specialties and Woodwork</b>				
Toilet Acc. (tp holder, garbage, paper towel disp.)				
Toilet Partition				
Dimensions				
Materials				
Grab Bars				
Dimensions				
Cabinets and Casework				



MODEL ELEMENT BREAKDOWN		3D W/ FACILITY DATA	2D W/ FACILITY DATA	2D W/O FACILITY DATA	DESCRIPTION/REMARKS
	Dimensions				
	Materials				
	Trim (e.g. chair rail)				
	Countertops				
	Dimensions				
	Materials (Plam, Solid Surface, etc.)				
<b>4.2.9</b>	<b>Signage</b>				
	Type				
	Mounting Height				
	Legend				
<b>4.2.10</b>	<b>Schedules</b>				
	Type, materials, and Finishes generated from Model				
<b>4.3</b>	<b>Furniture</b>				
<b>4.3.1</b>	<b>Furniture Coordination</b>				
	Furniture Dimensions				
	Type				
	Electrical Needs				
	Communication Needs				
<b>4.4</b>	<b>Equipment</b>				
	Dimension				
<b>4.4.1</b>	<b>Schedules</b>				
	Type, materials, and Finishes generated from Model				
<b>4.5</b>	<b>Structural</b>				
<b>4.5.1</b>	<b>Foundations</b>				
	Dimensional Info (L,W,D, Elevation)				
	Ftg Type (e.g. F1, F2, etc)				
	Legend				
	Footing Schedule				
<b>4.5.2</b>	<b>Floor Slabs</b>				
	Slab Dimensional Info				
	Composition				
	Sections and Details				
<b>4.5.3</b>	<b>Structural Steel</b>				
	Columns				
	Dimensional Information				
	Primary/Secondary/Roof Framing Members				
	Dimensional Information				
	Sections and Details				
	Floor Systems (Decks)				
	Dimensional Information (L,W,D, Elevation)				
	Sections and Details				
<b>4.5.4</b>	<b>Cast-in-Place Concrete</b>				
	Footing				
<b>4.5.5</b>	<b>Expansion/Contraction Joints</b>				
<b>4.5.6</b>	<b>Stairs</b>				
	Dimensional Information				
<b>4.5.7</b>	<b>Shafts and Pits</b>				
	Finished Dimensions				
<b>4.6</b>	<b>Mechanical</b>				
<b>4.6.1</b>	<b>HVAC</b>				
	Equipment (AHU's, fans, VAV's, Boilers, Pumps)				



[PROJECT TITLE]

[DATE]

MODEL ELEMENT BREAKDOWN		3D W/ FACILITY DATA	2D W/ FACILITY DATA	2D W/O FACILITY DATA	DESCRIPTION/REMARKS
	Ductwork				
	Registers, diffusers, grilles, etc.				
<b>4.6.1.1</b>	<b>Mechanical Piping</b>				
	Equipment (System specific pumps, tanks, etc.)				
	Piping >= 1.5"				
	Piping < 1.5"				
<b>4.6.2</b>	<b>Plumbing</b>				
	Piping >= 1.5"				
	Piping < 1.5"				
	<b>Fixtures</b>				
	Toilets, Urinals				
	Showers, Jan Sink, Drinking Fountains, DCVs				
	Sinks				
	Drains				
	Boiler Storage Tanks, Pumps				
<b>4.6.3</b>	<b>Equipment Clearances</b>				
	Dimensions				
<b>4.6.4</b>	<b>Elevator Equipment</b>				
	Car				
	Beam/Structure				
	Fly Wheel				
<b>4.7</b>	<b>Electrical/Telecommunications</b>				
<b>4.7.1</b>	<b>Interior Electrical Power and Lighting</b>				
	Lights				
	Receptacles				
	Panel Boards				
	Cable Tray				
	Conduit >1.5"				
	Conduit <=1.5"				
<b>4.7.2</b>	<b>Special Electrical Systems</b>				
	Security				
	Mass Notification				
	Public Address				
	Controls				
<b>4.7.3</b>	<b>Grounding Systems</b>				
	Devices				
	Wire				
	Rebar				
<b>4.7.4</b>	<b>Communications</b>				
	Cable Tray				
	Conduit >1.5"				
	Conduit <=1.5"				
	Controls, Connections Racks				
<b>4.7.5</b>	<b>Exterior Building Lighting</b>				
	Fixtures				
<b>4.7.6</b>	<b>Equipment Clearances</b>				
	Dimensions				
<b>4.8</b>	<b>Fire Protection</b>				
<b>4.8.1</b>	<b>Fire Protection System</b>				
	Piping				
	Fittings				
	Pumps				
	Tanks				
	Sensors				
	Panels				
<b>4.8.2</b>	<b>Fire Alarms</b>				
	Devices				





MODEL ELEMENT BREAKDOWN		3D W/ FACILITY DATA	2D W/ FACILITY DATA	2D W/O FACILITY DATA	DESCRIPTION/REMARKS
4.9	Civil				
4.9.1	Terrain (DTM)				
	Site Conditions				
	Grading				
4.9.2	Drainage				
	Drain System				
4.9.3	Storm Water and Sanitary Sewers				
	Systems				
4.9.4	Utilities				
	Systems				
	Gas lines				
4.9.5	Roads and Parking				
	Dimensions				
	Composition				

2. VARIANCES

List variances from minimum modeling requirements as specified in contract. Note: Variances must exceed minimum contract requirements of USACE RFP 01 33 16, Design after Award, Attachment F. (i.e. using newer release of AEC CAD Standard or IFC Version.)

VARIANCE	JUSTIFICATION



SECTION I: COLLABORATION PROCEDURES

1. COLLABORATION STRATEGY:  
Describe how the project team will collaborate. Include items such as communication methods, document management and transfer, and record storage, etc.
2. MEETING PROCEDURES:  
The following are examples of meetings that should be considered.

MEETING TYPE	REQUIRED PER CONTRACT	PROJECT STAGE	FREQUENCY	PARTICIPANTS	LOCATION
BIM REQUIREMENTS KICK-OFF					
BIM EXECUTION PLAN DEMONSTRATION	YES			w/ USACE	
DESIGN COORDINATION					
CONSTRUCTION OVER-THE-SHOULDER PROGRESS REVIEWS	YES				
ANY OTHER BIM MEETINGS THAT OCCURS WITH MULTIPLE PARTIES					



SECTION J: QUALITY CONTROL

1. OVERALL STRATEGY FOR QUALITY CONTROL

Describe the strategy to control the quality of the model.

2. QUALITY CONTROL CHECKS

The following checks should be performed to assure quality.

CHECKS	DEFINITION	RESPONSIBLE PARTY	SOFTWARE PROGRAM(S)	FREQUENCY
VISUAL CHECK	Ensure there are no unintended model components and the design intent has been followed			
INTERFERENCE CHECK	Detect problems in the model where two building components are clashing including soft and hard			
STANDARDS CHECK	Ensure that the BIM and AEC CADD Standard have been followed (fonts, dimensions, line styles, levels/layers, etc)			
MODEL INTEGRITY CHECKS	Describe the QC validation process used to ensure that the Project Facility Data set has no undefined, incorrectly defined or duplicated elements and the reporting process on non-compliant elements and corrective action plans			



## SECTION K: TECHNOLOGICAL INFRASTRUCTURE NEEDS

### 1. SOFTWARE:

List software used to deliver BIM. Remove software that is not applicable.

BIM USE	USER	SOFTWARE	VERSION
DESIGN AUTHORING	ARCH	XYZ DESIGN APPLICATION	
DESIGN AUTHORING	STRUCTURAL	XYZ DESIGN APPLICATION	
DESIGN AUTHORING	MECHANICAL	XYZ DESIGN APPLICATION	
DESIGN AUTHORING	ELECTRICAL/TELECOM	XYZ DESIGN APPLICATION	
DESIGN AUTHORING	PLUMBING	XYZ DESIGN APPLICATION	
DESIGN AUTHORING	FIRE PROTECTION	XYZ DESIGN APPLICATION	
DESIGN AUTHORING	CIVIL	XYZ DESIGN APPLICATION	
4D MODELING		4D MODELING SOFTWARE	
COST ESTIMATION		COST ESTIMATION SOFTWARE	
EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING SOFTWARE	
SITE UTILIZATION PLANNING		SITE UTILIZATION PLANNING SOFTWARE	
CONSTRUCTION SYSTEM DESIGN		CONSTRUCTION SYSTEM DESIGN SOFTWARE	
DIGITAL FABRICATION		DIGITAL FABRICATION SOFTWARE	
3D CONTROL AND PLANNING		3D CONTROL AND PLANNING SOFTWARE	
3D COORDINATION		3D COORDINATION SOFTWARE	
DESIGN REVIEWS		DESIGN REVIEWS SOFTWARE	
STRUCTURAL ANALYSIS		STRUCTURAL ANALYSIS SOFTWARE	
LIGHTING ANALYSIS		LIGHTING ANALYSIS SOFTWARE	
ENERGY ANALYSIS		ENERGY ANALYSIS SOFTWARE	
LEED EVALUATION		LEED EVALUATION SOFTWARE	
CODE VALIDATION		CODE VALIDATION	
PROGRAMMING		PROGRAMMING	
SITE ANALYSIS		SITE ANALYSIS	



**2. BIM AND CAD STANDARDS:**  
Identify items such as the BIM and CAD standards, USACE Bentley BIM Workspace version (if COS Facility), and the version of IFC, etc.

STANDARD	VERSION
USACE Bentley BIM Workspace:	
CAD Standard:	
IFC:	VERSION/MVD(s)



SECTION L: MODEL ORGANIZATION

1. FILE NAMING STANDARD:  
List examples of file names by discipline based on USACE BIM FILE NAMING STANDARD.
2. MODEL STRUCTURE:  
Describe and diagram how the Model is divided up. For example, by building, by floors, by zone, by areas, and/or discipline.
3. MEASUREMENT AND COORDINATE SYSTEMS:  
Describe the measurement system (Imperial or Metric) and coordinate system (geo-referenced) used.



SECTION M: PROJECT DELIVERABLES

In this section, list the BIM deliverables for the project and the format in which the information will be delivered. SEE SECTION FOUR OF USACE RFP 01 33 16 DESIGN AFTER AWARD, ATTACHMENT F FOR REQUIREMENTS

BIM SUBMITTAL ITEM	STAGE	FORMAT	NOTES
QA/QC reports – Model Standards Check Report (2.3.1)			
QA/QC reports – CAD Standards Check Report (2.3.2)			
QA/QC reports - Other Model QA/QC Reports (2.3.3)			
QA/QC reports - Visual Check Report (2.4.1)			
QA/QC reports - Interference Report (2.4.2)			
IFC file (2.4.3)			
QA/QC reports - Other Design QA/QC Reports (2.4.4)			
Visualization Model (Navigator, Navisworks, 3dPDF, Google Earth, etc) (3.1.3)			
List of all submitted files (Excel spreadsheet preferred) (3.1.3)			
Interim Design Submittal(s) (3.3.1)			
Final Design Submittal (3.4.1)			
Construction Submittals - Over-The-Shoulder Reviews (3.5)			
As-Built Submittal (3.6)			
[Other BIM Deliverables]			



## SECTION N: ATTACHMENTS

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1. **LEVEL 1 PROCESS OVERVIEW MAP** [FROM SECTION F]
2. **LEVEL 2 DETAILED BIM USE PROCESS MAP(S)** [FROM SECTION F]
3. **INFORMATION EXCHANGE REQUIREMENT WORKSHEET(S)** [FROM SECTION G]
4. **FILE NAMING STANDARD** [FROM SECTION L]

